BULLETIN
of the
BUSINESS HISTORICAL SOCIETY

Vol. XXVII JUNE 1953 Number 2

A GERMAN EIGHTEENTH-CENTURY IRON WORKS DURING ITS FIRST HUNDRED YEARS:

Notes Contributing to the Unwritten History of European Aristocratic Business Leadership

In connection with some research on the beginnings of German business history[1] the author of this paper has drawn attention to what is probably the earliest firm history ever written. This history of an iron works, entitled *Geschichte und Feyer des Ersten Jahrhunderts des Eisenwerks Lauchhammer*, was compiled by the Works' general manager, Johann Friedrich Trautscholdt, and privately printed in Dresden in 1825.[2] Of the literally thousands of firm histories which have been issued in Europe and America since that time, only a few can bear comparison with this very first one, a truly remarkable performance. It is typically what the Germans call a *Festschrift*, *i.e.*, a publication to celebrate an anniversary. This article, based thereon, will show what a mine of information that early firm history is; but hard work was necessary to bring the gold to the surface.[3]

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[1] The study has been published under the title "The Beginnings and Development of German Business History," a Supplement to the BULLETIN OF THE BUSINESS HISTORICAL SOCIETY, Sept., 1952.

[2] The title reads in English: *History and Celebration of the Hundredth Anniversary of the Lauchhammer Iron Works*; iii, 83 pages, one frontispiece and 2 maps. There exist two slightly different editions in several German libraries. Microfilms of those in the *Sächsische Landesbibliothek* in Dresden are in Baker Library of Harvard University. The book's author, Trautscholdt, will be studied in detail (see third installment of this article).

[3] Trautscholdt's book will be quoted hereafter as *F.* (this letter standing for the German *Festschrift*). However, in view of the small size of the item, citations will be kept to a minimum. In 1925 the Linke-Hofmann-Lauchhammer Werke, a merger which had absorbed the old Lauchhammer Works, published another *Festschrift* which cannot bear comparison with the first. But to the extent that it contains supplementary information, that book, entitled *200 Jahre Lauchhammer 1725-1925* (p. p. [1925]), has been used and will be cited *F. of 1925*. It is full of small errors.

For the background, see Ludwig Beck, *Geschichte des Eisens in technischer und kulturgeschichtlicher Beziehung*, 5 vols. (Braunschweig, 1893-1903), and James M.

I

THE WORKS' OWNERS AND THE BEGINNINGS

The Lauchhammer Works, located in what was then part of the Electorate of Saxony, owed its existence to eighteenth-century aristocratic landowners. Lauchhammer was at that time part of the estate (*Rittergut*) Mückenberg which since the fifteenth century had been owned by a branch of the von Schleinitz family. Before the last scion of that branch died without issue, the estate was sold by the presumptive heirs to the minister and marshal of the Polish and Saxon court, Woldemar Freiherr von Löwendal (1660-1740) who in 1716 took possession of the property after the former's death. The new proprietor, in turn, in 1718 transferred ownership to his second wife, Benedicta Margaretha née von Rantzau. The Rantzaus are an outstanding noble family of Holstein, a line of which had become Danish.

Freifrau von Löwendal, a descendant of the Danish line of the Rantzaus and an able and energetic lady, had the misfortune of losing all her children and probably sought another outlet for her energies. Her Mückenberg estate had a rather low value. It was out of the way, had suffered during the Thirty Years' War, the soil was poor, and most of the property was covered with timber, if it did not consist of swampland. Recognizing that the estate could be developed by exploiting its forests and that the peasants needed help, Freifrau von Löwendal decided to erect a sawmill. The peasants would then earn an extra income through lumbering and transporting the lumber to the mill, while the estate's timber would become a revenue-producing asset. However, when the foundation of the mill was laid, iron ore was discovered. Thereupon Freiherr von Löwendal, whose interest in metallurgy is a matter of record, suggested to his wife that an iron works be established in lieu of a sawmill. Thereby the estate's timber resources would be exploited in the production of charcoal and, if they were to prove insufficient, large reserves were available in the

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Swank, *History of the Manufacture of Iron in All Ages* (2d ed.; Philadelphia, 1892). Beck has given in III, 900-905 and IV, 105, 106 a short history of the Lauchhammer Works.

For the translation of the German technical terms the author has relied on Schlomann-Oldenbourg, *Illustrated Technical Dictionaries in Six Languages*, XI, *Metallurgy of Iron*, compiled by William Venator and Dr. Colin Ross (London, 1911).

nearby forests of the Elector. Thus in 1725 the Lauchhammer Iron Works came into existence.

The following preparations were made: A blast furnace was located at a point between a pond, which was dammed, and the Schwarze Elster River, a tributary of the Elbe. A sufficient water supply as source of power was made available by digging a mill canal between pond and river and by diverting a stream into that canal, at a cost of about 465 talers, no mean undertaking for the time. A ditch both for drainage and the removal of the waste waters was also dug. Downstream, to the west of the furnace, at a distance of about one and a half miles, forges were built which would work up the crude iron produced by the furnace. Since the canal was dug through swampland the estate as such was also improved.

According to Mercantilist practice, mining and smelting were then closely government controlled. The legal basis for such control was the so-called *Bergregal*, *i.e.*, under medieval German law underground minerals were considered as owned by the sovereign who for a certain remuneration would give mining concessions, retaining the right of direction. Since the Löwendals were a powerful family,[4] they had no difficulties, of course. The Saxon mining authority, the *Bergamt*, was most co-operative and in 1722 our energetic lady, before actually starting on her venture, had received the privilege of erecting:[5]

1 blast furnace
7 fineries and forges
1 foundry
1 wire plant
1 malt house
1 brew house
1 rye distillery
1 butchery
1 store for providing the workers with victuals, clothing, and the like

One sees at first glance that the founder's ambitions were great; a truly large enterprise was to be established. But for lack of water power the accomplishment remained originally far behind the plan.

Actually on August 25, 1725, the blast furnace was put into operation; two forges, Oberhammer and Mittelhammer, became ready in 1725 and 1726, respectively. In 1728 the third of the forges, the

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[4] One gets a good idea of the Löwendal family by reading the articles "Lowendahl (le maréchal Ulric-Frédéric-Woldemar de)" in *Biographie Universelle Ancienne et Moderne*, Nouvelle Edition (Paris, n.d.), XXV, 376 ff., and the shorter one in the *Nouvelle Biographie Générale*, XXXII (Paris, 1863), 83.

[5] For the details of the concession, see Beck, *op. cit.*, III, 900, 901.

Unterhammer, became available; in 1729 it was followed by a fourth, the Grünewalder Hammer, which was built to produce bar iron, iron rods, and *Zeugeisen*[6] and to make use of another source of water power.

Those less familiar with the history of iron production may appreciate being reminded that at that time crude iron was produced in blast furnaces with charcoal. Such crude iron could be used directly as foundry iron or it could be brought to forges for the production of wrought iron in its various shapes. Since steel production was not set up at Lauchhammer, a refinery was for the time being neither needed nor actually established.

What was needed immediately, however, were mining and water rights. As a matter of fact mining rights for bog ore were acquired in 1737 and 1761, and water rights in 1747, 1749, 1754, 1760, 1761, and 1764. In some cases water was made available by drainage, and peasants were contractually obligated to keep ditches and dams in good order. They received for their labor a certain amount of money per year and in one case a certain amount of iron each Michaelmas. It may be assumed that the peasants making the latter arrangement were the village blacksmiths. One Johann Müller, who in the 1740's acquired a reputation as an expert in the field, was praised for his foresight in planning and for his efficient advice regarding the Works' water supply.

So much about the start; the later development of the enterprise will be treated in Section II of this article.

Freifrau von Löwendal died in 1776 and her Mückenberg estate with the Lauchhammer Works was inherited by Count Detlev von Einsiedel (1737-1810), who prior to taking possession had already familiarized himself with the Works. The new owner, who ranked high among his contemporaries, was the fifth son of Hans Georg Count von Einsiedel (1694-1760), the marshal of the Royal Polish and Electoral Saxon Court, and his wife née Countess Flemming. Count Detlev when young had been educated in the Latin school (*Gymnasium*) in Görlitz and the universities of Wittenberg and Strassburg. Thereafter, as was common for young noblemen of his time, he traveled, namely, in France, the Imperial Low Countries, and the United Provinces. Upon his father's death Count Detlev took over the ad-

[6] The German word *Zeug* is used for so many different things that the term *Zeugeisen* is not clear. It probably meant iron for tools and implements.

ministration of the former's estates. Having received his first appointment in 1757, the able man rose fast in the Saxon government service, reaching in 1782 the high position of a *Conferenz Minister*. In 1787 he retired to his estates and personally administered his iron works, although he went on fulfilling occasional public duties.

Detlev von Einsiedel was one of those eighteenth-century noblemen who both as officials and landowners took a great interest in promoting their territory's welfare by developing agriculture, manufactures, and industry. As early as 1777, he sent in official capacity competent men to Spain, who by permission of the King of Spain brought several hundred merino sheep to Saxony. This import, together with an earlier and a later one of 1765 and 1778, respectively, was of the greatest importance, for thus the basis was laid for the extraordinarily flourishing Saxon wool production of the first half of the nineteenth century. In fact it was Saxony which first proved that merinos could live and flourish outside of Spain. In close connection with these endeavors Detlev von Einsiedel built better, and probably water driven, implements for the preparing and spinning of wool and encouraged the imitation of those devices. Moreover, he experimented with the coking of peat and the production of chemicals, such as saltpetre, sal ammoniac, liquid ammonia, and sulphuric acid. Detlev von Einsiedel is even supposed to have had his hands in the building of the earliest Saxon steam engine.[7] Undoubted is his interest in the construction of hard-surfaced roads in Saxony: one or several of them he built on his own account on his estates, where he also erected schools and churches.

That an enlightened nobleman of this caliber could administer an iron works goes without saying. In fact, Count Detlev von Einsiedel was an extraordinarily able executive and is considered to have been one of the German leaders in eighteenth-century metallurgy. He was a man of ideas and possessed at the same time the capacity of finding

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[7] The following facts can be established at this time: In 1809 the Lauchhammer Works cast parts of a steam engine for the salt works at Dürrenberg on the basis of models received. The latter were the work of the Saxon mining official, Christian Friedrich Brendel (1776-1861), who had been sent to England to study her modern machines and who in 1811 became the engine master at Dürrenberg. See *F.*, 36,67; Conrad Matschoss, *Die Entwicklung der Dampfmaschine* (Berlin, 1908), I, 162; and my essay "The Leaders of the German Steam Engine Industry during the First Hundred Years" in *Journal of Economic History*, IV (1944), 137, 138.

both competent advisers and able executors for his projects. For advisers he relied on high-class Saxon mining officials; one of them, Freiherr von Heinitz, who at one time actually gave advice to the Count, later became a Prussian minister and a man of historical importance. In the second instance he drew on leading engineers and scientists, some of whose names will be recorded later.[8] Workers were trained for the purposes at hand. In connection with the development of the casting, from iron, of objects of art and with the enameling of utensils, to be discussed later, Count Einsiedel became a creative entrepreneur. He not only achieved technological progress and put new production methods into operation, but he also created new articles for which he had to develop his own market. It is noteworthy that the monograph of 1825 expressly made this point.[9] To find an eighteenth-century European aristocrat in this role will probably come as a surprise to most American readers.

Although keeping up his interest and continuing to give advice, in 1804 the Count retired from the active administration of the iron works.

In 1745 Detlev von Einsiedel had married Sidonie Albertine Countess Schönburg-Liechtenstein; their sixth son, receiving his father's given name, was Detlev Count von Einsiedel, Jr. (1773-1861).[10] The young Count was educated at a school in Dresden and the University of Wittenberg. Thereafter he traveled in Silesia and studied the province's famous iron industry. In 1794 he entered the Saxon government service and, rising quickly, was used in various capacities, proving his worth as an administrator. Moreover, in 1805 the young nobleman, taking the reins from his father, became the administrator of the latter's estates, including the Lauchhammer Works. After his father's death, although only a part owner, Einsiedel, Jr., became the ultimate power in the enterprise. In the meantime, in 1806, he had been appointed *Kreishauptmann im Meissenschen Kreise.* Such jobs in the eighteenth century usually went to noblemen owning estates in the district in question, preferably to such men as had studied law. The

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[8] See second installment.

[9] See *F.*, page 24.

[10] See the biographies in *F.*, 17 ff.; *Allgemeine Deutsche Biographie,* V (Leipzig, 1877), 760, 761; Karl von Weber, "Detlev, Graf von Einsiedel, Königlich Sächsischer Cabinets-Minister" in *Archiv für die Sächsische Geschichte,* I (1863), 58 ff., 129 ff.; Eduard Johnson, "Zur Lebensgeschichte des Kabinetts-Ministers Detlev Graf von Einsiedel" in *Neues Archiv für Sächsische Geschichte,* XII (1891), 185 ff.

Kreishauptmann's function was the representation of the territorial government in what can be compared with a county; he was responsible for the execution of public policy on the local level. Again young Count Detlev showed great acumen, so that in 1813, presumably at the request of Napoleon I, in a most critical moment he became a minister charged with interior, economic, and military matters and later also with foreign affairs. He could not stave off disaster. The Battle of Leipzig in October of that year determined the fate of his master. The King of Saxony (the former Elector), Napoleon's ally, was taken prisoner and Count Detlev accompanied him into captivity. In 1814 and 1815 we find him on the Vienna Congress negotiating in behalf of his sovereign who under the peace treaty was permitted to return to a diminished realm. Count Detlev as a *Cabinets-Minister* for more than a decade then became the most powerful man in the country. His great administrative ability enabled him to rebuild economic life in the war-devastated areas and to develop business everywhere. As a statesman he was what would be called a reactionary today, following the line of Prince Metternich. Thus tainted as a protégé of Napoleon, hated by the population for his restrictive policy and as a hypocrite in church matters, he was dismissed when revolution threatened in 1830. He left office under the cloud of having abused his great power in the interest of his private industrial interests which represented for the time almost an industrial empire.

II

THE WORKS' EXPANSION OVER ONE HUNDRED YEARS

The beginnings of the Lauchhammer Works have been described and the reader is familiar with the three persons who determined its fate during the first hundred years of its existence. He knows the Works as it stood in 1730, with its furnace and four forges, and is aware of the fact that valuable water and mining rights had been acquired in the following decades. In 1776 when Freifrau von Löwendal died, the fixed capital of the enterprise consisted of:

Lauchhammer
1 building containing furnace and foundry;
2 storage buildings for iron and coal, respectively;
2 shacks for tools, patterns, and molds;
1 dwelling for the factor;
2 dwellings for workers, one of them a multiple-unit dwelling;
1 stable and barn;
the remainder of an old mill used as a tavern.

Oberhammer Mittelhammer Unterhammer Grünewalder Hammer	))))	each	1 bar forge 1 coal shack 1 dwelling.[11]

(The contemporary word *Hammer* is equivalent to the English word forge.)

At that time all the buildings were of wood. Only after the Works had learned to use the furnace cinders to produce bricks were the wooden buildings eventually replaced by brick buildings. Prior thereto the danger of a conflagration was a very high one, but actually the plants were spared any major disaster. As a matter of fact, the Unterhammer had a fire in 1818, but within about a month the damage was repaired and the plant went into operation again.

Unfortunately we know neither the amount of capital sunk in the plants before they were taken over by Freifrau von Löwendal's heir nor their value as a going concern. But we are able to present a reasonable estimate. As will be mentioned shortly, in 1790 Count von Einsiedel acquired an iron works consisting of one furnace and two forges, one of which lay in ruins. It was located in the same area as the Lauchhammer Works, but had been badly administered by its aristocratic owner and was run down. For that establishment Count von Einsiedel paid 5,000 Reichstalers. This figure points to the conclusion that in that year the Lauchhammer Works' value as a going concern must have been about 25,000 Reichstalers.

Count von Einsiedel had hardly taken over when he started his Works on the road toward improvement (to be discussed later)[12] and expansion. In 1777 a smithy was built for the production of nails and tools which, incidentally, was enlarged in 1821; in 1779 and 1780 a bar forge was erected at Gröditz, while in 1781 the Mittelhammer plant

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[11] The American reader may get the "feel" of the Lauchhammer Works in the Löwendal era by reading Irene D. Neu, "The Iron Plantations of Colonial New York" in *New York History* (January, 1952), and Arthur Cecil Bining, *Pennsylvania Iron Manufacture in the Eighteenth Century, Publications of the Pennsylvania Historical Commission*, IV (Harrisburg, 1938), especially 30-36, 67 ff., 107 ff. The reader will find many similarities and telling dissimilarities and should understand especially that the technique used in German forges was different from that described by Bining. Useful for purposes of comparison is also the story of the Hope Furnace in James B. Hedges, *The Browns of Providence Plantations: Colonial Years* (Cambridge, Massachusetts, 1952), 123 ff.

[12] See second installment.

received a second such forge. In 1789 a stampmill (to be improved in 1808) for the crushing of limestone went into operation at Gröditz, the logical location, since limestone came then by barge as far as that place where it was loaded on wagons. In 1790 we find the first case of external growth; as alluded to above, another enterprise was acquired, the Burghammer Works, located on a small river, the Kleine Spree, near Hoyerswerda about seven and a half miles from Lauchhammer. That enterprise, a very old one first mentioned in 1556, consisted of a furnace, smaller than that at Lauchhammer, and two forges of which one had burned down. The latter, called the Spreewitz forge because of its location near that village at a distance from the Burghammer plant, was rebuilt in 1791. In the same year, in the wooded area of Coyne about five miles from Lauchhammer, a forge was constructed at a point where a stream flowing out of a pond provided some power.

The result of this impressive policy of expansion becomes evident from a short description of the Lauchhammer enterprise, designated as the "Gräflich Einsiedelsche Eisenfabrik" in a contemporary German directory of manufactures.[13] The enterprise is described therein as follows: "foundry and forge, near Mückenberg in the Electorate of Saxony, consisting of 1 blast furnace, 1 finery and bar forge, 2 *Schaufelfeuer*, 1 bar forge, 1 plate mill, one wire mill.[14] It excels through the beauty of its foundry products and also casts ammunition and cannons."

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[13] Johann Christian Gädicke, *Fabriken- und Manufakturen-Adress- Buch von Teutschland und einigen angränzenden Ländern* (Weimar, 1799), II, 279. The note reads in German: "1 Hochofen, 1 Frisch- und Staabfeuer, 2 Schaufelfeuer, 1 Zaynhammer, 1 Blechfeuer, 1 Eisendrahtmühle"; see also *ibid.*, I, 152, 194. The Burghammer Works received a short note in vol. II, 78.

A detailed contemporary description of the Lauchhammer Works as it stood in the 1800's is to be found in Wilhelm August Lampadius, *Handbuch der allgemeinen Hüttenkunde, des Zweyten Theiles vierter Band enthält die hüttenmännische Benutzung der Eisenerze überhaupt, so wie der Frischprocesse und der Stahlfabrikation* (Göttingen, 1810), 296 ff.

[14] This translation of the German note is unsatisfactory: the word *Schaufelfeuer* appears neither in Jacob und Wilhelm Grimm's *Deutsches Wörterbuch* nor in Beck's standard work on iron (see footnote 3). The author is unable to translate or even to explain the term. Moreover for the German terms Stabhammer and Zaynhammer the English language has only the equivalent "bar forge," while the German terms indicate two different shapes of iron bars. It is doubted whether the plate mill actually existed; it may have been in the planning stage when the author of the 1790's received his information. It did or would have hammered plate. As to the doubt, here expressed, see *Stahl und Eisen*, XXV (1905), 1232.

Further expansion between about 1800 and 1825 ties in so closely with the Works' policy of improvement that it will be treated in that context.[15]

III

CHARACTER OF PRODUCTION AND OUTPUT

Although the Lauchhammer Works started by importing skilled workers from the Saxon Erzgebirge, partly for the purpose of training local hands, the enterprise's first years were very difficult ones, at least as far as the forge production was concerned. Those in-migrants[16] were not accustomed to the quality of the Lauchhammer crude iron, which probably contained more phosphorus than that to which they were accustomed, and it took them seven years before they could produce satisfactory wrought iron.

In the Löwendal era and during the first years of the elder Einsiedel the furnace produced crude iron for the forges and cast objects for sale and for the use of those forges. Among the first-named cast products were pots, kettles, pipes, stoves, stove plates, and the like; among the latter, anvils, hammers, and hearth plates. The forges in turn produced axles, wheel tires, rails, plough shares, and, on the other hand, iron bars, rods, etc., as demanded by smiths and various

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[15] See second installment.

However, by way of a footnote, attention must be drawn to an episode of 1830, because it sheds much light on the spirit of the younger Einsiedel's administration, a strange mixture of technical progressivism and political backwardness. In that year the Gröditz plant, then already in a process of expansion, was to be further enlarged by a second blast furnace, presumably a coke furnace, to which a puddling furnace was to be attached. A tin plate plant was to be added. The application for a concession was coupled with the request for the delivery of a certain amount of charcoal per annum from the royal forests and for a ten-year special privilege. No other works of that description were to be erected during that period in the part of the kingdom in which the plants were to be established; existing enterprises were to be enjoined from building competing ones. That is to say, in the spirit of the eighteenth century the application was conditioned on a special privilege. Thereby it did not fit into the political climate of the nineteenth century. The Count was so conservative that he probably acted bona fide, but the public sensed an intention to abuse political power for business purposes. The concession was granted without the special privilege, but the concessionaire made no use of it; see von Weber, *op. cit.*, 185 ff.

[16] The terms in-migrant and out-migrant connote migrants within a country. The words were used by government agencies during World War II.

craftsmen. This branch of the Works' production was most important, the foundry business was rather neglected. The note previously quoted from an industrial directory of the 1790's indicates that the enterprise was by that time also engaged in the production of wire, ammunition, and guns (possibly also in that of hammered plate), but we do not know when the plants went into those fields. Be that as it may, since the nearest competing furnaces and forges were far away in the Saxon Erzgebirge and since the area in which Lauchhammer is located began to recover from the ravages of the Thirty Years' War in the course of the eighteenth century, the Works' output found a ready sale, although produced at high cost. This disadvantage was due to inaccessibility. The plants were far from navigable rivers and not even close to main roads. Limestone, for example, had to be shipped from Pirna and Meissen over a relatively wide distance. In the early years (Pirna) limestone was brought by wagon from Dresden, later it came on the Elbe as far as Grödel, whence it had to be transported by wagon. From about 1785 on it could be reshipped from Grödel in barges to Gröditz and thence brought the last twenty miles to Lauchhammer over poor dirt roads.

Except with respect to limestone, the Lauchhammer Works was a self-sufficing enterprise. The output was based on the concern's own mining of bog ores and burning of charcoal, neither of which presented serious problems. Bog ore was usually no more than one to three feet below the surface, so that it could easily be taken out once the top soil was removed. Thereafter it was washed and dried in the air for a rather long time. By 1775 charcoal was becoming scarcer because of the depletion of the nearby forests, as was the case at that time in most areas of older iron production. For relieving this charcoal shortage the Works began in 1778 to have stumps dug up and used; in 1796 a machine was built for that purpose.

In the era of the elder Count Einsiedel the greatest progress in the Lauchhammer Works' production, in fact genuine primary innovation, took place in the previously neglected field of foundry products. As early as 1780 the first preliminary step was being taken: a collection of plastic art, as a matter of fact mostly plaster casts, was brought together and, incidentally, considerably enlarged when in 1785 casts of ancient statues were ordered in Rome. The move of 1780 indicates that by that time the casting of objects of art was being contemplated by the Count. This branch of iron casting, in German

called *Eisenkunstguss*,[17] had started in Europe in the fifteenth and sixteenth centuries with the casting of ornamental stove plates. When in the eighteenth century the cupola furnace was invented in England by the famous ironmaster John Wilkinson, some of her foundries went further and began casting medallions. About the same time the use of cast iron for architectural purposes was first being contemplated, and the earliest cast iron bridge (crossing the Severn) was actually erected at Coalbrookdale in 1779. But no figures (statues) had ever been cast prior to 1784.

Against this background the actions taken in the Lauchhammer Works can be understood. In 1781 a sculptor was hired, quickly followed by a second, to make the patterns of such objects of art as were to be cast. In 1782 the first attempt was made at casting a figure, but it was a failure because gypsum was used for the mold. The artist had suggested this material expecting that it was best suited to bring out the details and the beauty of the original. In 1783 another attempt was made, the artist still insisting on the use of gypsum, but in 1784 the material for the molds was changed. In the latter year a wax model was made and successfully cast in loam.[18] At least five years had elapsed after the decision had been made to attempt this innovation, and it had taken three to four years to pass the experimental stage. But then the Lauchhammer Works was on the right track and quickly acquired experience in the new field, so that it could cast from iron even complicated objects of art, going beyond everything that had been achieved before.[19]

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[17] For the background, see J. Starkie Gardner, *Iron Work*, I (London, 1893), II (London, 1896); Henri Clouzot, *Les Arts du Métal . . .* (*Manuels d'Histoire de l'Art*), (Paris, 1934), 283 ff.; Julius Lasius, "Zur Entwicklungsgeschichte des Eisenkunstgusses" in *Stahl und Eisen*, XXVIII (1908), 385 ff.; and especially Hermann Lüer and Max Creutz, *Geschichte der Metallkunst*, I (Stuttgart, 1904), 255 ff. It is obvious from all those works, that iron objects of art were traditionally made by fire and hammer and that, by 1500, artisans learned to work also with other tools on cold iron. According to Clouzot (*op. cit.*, 352), the casting of iron objects in general expanded after 1780; Lüer and Creutz date that expansion from 1800. The former author mentioned the Lauchhammer Works among the pioneers, the latter devoted a whole paragraph (on page 258) to its achievements in the field.

[18] A picture of this first figure cast from iron is in *F. of 1925*, 48.

[19] Contemporary reports on the achievement are to be found in *Journal des Luxus und der Moden*, I (1786), 366 ff.; XII (1797), 321, 322.

(*Continued on page 82*)

TABLE 1

THE PRODUCTION OF CAST-IRON OBJECTS OF ART AND RELATED GOODS

	1784–89	1790–95	1796–1800	1801–05	1806–10	1811–15	1816–20	1821–25
Objects of Art [a]	37	37	63	28	9	14	8	19
Ornamental Objects [b]						9	511	4,054
Architectural Objects [c]			20	1	2		5	25

[a] Include figures, dual figures, portraits, busts, animals, vases, tripods, etc., monuments and parts thereof, baptismal fountains, low reliefs.

[b] Include ornamental objects of various kinds.

[c] Include balcony parts, railings, *frontons* (a *fronton* is an ornamental roof in gable form over a door or window), coffins, bridge parts, gates, pillars, clasps of doors.

Having explored the beginnings, we must discuss in some more detail the Works' actual production of cast-iron objects of art.[20] The very first statue cast in iron was followed in the same year by a bust. Figures and busts, produced in the early years, were mostly copies of classical and neoclassical works of art as they were in fashion at that time. Statues and busts were hollow; the walls were thin and protected against rusting by a bronze cover. Consequently, although five to six feet high, the statues were not too heavy, so that they could be used not only in city squares, in parks, and park temples (as they were then in fashion), but also on parapets and as headpieces of stoves, as will be described forthwith. In 1789 the first portrait busts were cast, usually one of each pattern, only in exceptional cases more than one. In 1793 progress had been made to the point where it was possible to cast in one piece dual figures, such as Castor and Pollux, a remarkable technical achievement.

Akin to this production was that of ornamental objects, such as statues of animals, vases, monuments for graves, baptismal fountains, etc.; of a slightly different character were medallions. In 1786 a medallion in high relief copying a classical model was offered at 5 talers, while four different ones in low relief, cast on the basis of designs of Bouchardon,[21] sold at 6 talers. Before long the Works also went into the production of cast-iron objects for architectural purposes, which was in line with the earlier English development. Parts

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(*Continued from page 80*)

A modern scholarly treatment is in Hermann Schmitz, *Berliner Eisenkunstguss. Festschrift zum fünfzigjährigen Bestehen des Königlichen Kunstgewerbe Museums* (München, n.d. [1917]). 5 ff., especially 12, 13. On page 12, there is a picture of an early bust, cast by the Lauchhammer Works in 1789 or 1795, that of Freiherr von Heinitz. Other pictures of Lauchhammer's early castings, are in *F. of 1925*, plate after page 54, while one of a dual figure (Castor and Pollux), to be dealt with presently, is to be found as figure 18 in the above-cited *Journal des Luxus und der Moden*, XII (1797), May issue. This statue had been sold for the grand-ducal park in Weimar.

The following pertinent book is not available in America: *Lauchhammer als Bildgiesserei in Eisen und Bronce* (Leipzig and Berlin, 1899; Giesecke and Devrient).

[20] See the list in *F.*, 54 ff., which is the basis for Table I on page 81 of this article.

[21] Edme Bouchardon (1698-1762), renowned French sculptor.

of bridges and balconies, leafs of doors, gates, pillars, and the like were cast.

In the class of ornamental objects we have to count also cast-iron stoves of artistic character, the manufacture of which deserves detailed treatment. These stoves, produced between 1790 and 1797, were very elaborate and expensive objects, described as "cast iron stoves with copies of classical figures as top pieces."[22] They were first offered in 1786 as follows:

1. Enameled stove with statue of Ganymed			
the stove and accessories	at	75	Reichstalers
the statue	"	100	"
		175	"
2. Therme-stove[23] with bust			
the stove and accessories	"	65	"
the bust of Socrates	"	30	"
		95	"
3. Altar-stove with bust			
the stove and accessories	"	55	"
the bust of Commodus	"	30	"
		85	"
4. Round stove with ornamental shields and bands			
the stove and accessories	at	40	"
Bust of Empress Crispina, wife of Commodus	"	25	"
		65	"

The stoves in the form of altars, monument bases, and the like were square or round, covered with bronze or enamel so as to be rust resistant, and they were richly ornamented with festoons, arabesques, low or high reliefs. The latter were at sizes of about 6 inches, 2 feet, and higher, and were intended to be used also on houses, monuments,

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[22] Gädecke, *op. cit.*, I, 194 ("gegossene Öfen mit Aufsätzen von Figuren nach Antiken"). For examples, see *F. of 1925*, plate following page 54; *Journal des Luxus und der Moden*, plate XXX, Oct., 1786.

[23] This term is not understandable.

fountains, and the like.[24] Sixteen such stoves were produced between 1790 and 1797.

What then were the motives which induced Count Einsiedel to become a creative entrepreneur and to bring into existence this new line of production, the casting from iron of objects of art? It is reported that he was a patron of the arts, so that to him, as an iron manufacturer, the idea of casting objects of art in iron presented itself almost automatically. Moreover, Lauchhammer crude iron was thinly liquid and lent itself to such an experiment. We would like to know if a business consideration played at least a supplementary role. The Lauchhammer Works, as mentioned, was a high-cost producer because of its high transportation costs; these costs would not count, however, once this attempt at innovation was successful. We have no answer to this question.

At this point a study of Table 1 is rewarding since it shows in detail the development over forty years of the Works' production in cast-iron objects of art and related products. The production was never large, as would be expected, especially in view of the high prices of the articles. One may take it for granted that those objects were made on order only. But, as the table shows, by 1816 the program changed and production was extended to small ornamental objects, such as candlesticks, bowls of pipes, cigar holders, knife and fork rests, etc. In this period busts shifted into this class. Changing their character the Works probably cast small busts of Blücher, Napoleon, and the allied monarchs, but this is only a surmise based on knowledge of the period's culture. From 1816 on we may speak of mass production of cast-iron ornamental objects, small as the figures may appear

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[24] This description of the stove production of the Lauchhammer Works is based on the essay "Ueber die eisernen Guss-Arbeiten der Gräfl. Einsiedelschen Eisen-Fabrick zu Lauchhammer bey Mückenberg in Sachsen" in *Journal des Luxus und der Moden* (as cited in footnote 19), 1786. The paper was written by no less a person than F. J. Bertuch (1747-1822), the reputable Weimar writer and publisher who took a great interest in the promotion of industry; see Albrecht von Heinemann, *Friedrich Johann Justin Bertuch, ein Weimarischer Buchhändler der Goethezeit* (Bad Münster am Stein, 1950).

The statue of Ganymed offered with stoves of type 1 was copied from a famous ancient statue in the park of Sanssouci near Potsdam, a statue which the author has seen a great many times.

Stoves, as first produced and marketed by the Lauchhammer Works were later also made by some of its competitors; see *Vom Ursprung und Werden der Buderusschen Eisenwerke [zu] Wetzlar* (München, 1938), I, 262, 263.

to a present-day American; and it implies that there must have been production for the market.

After the Wars of Liberation the Works took an increasing interest in the casting both of industrial implements and of steam-engine and other machine parts; it ultimately went into the production of complete steam engines as well as of agricultural and other machines. This was the logical development of a line which had been entered during the administration of the elder Einsiedel. As early as 1785 he had started casting light water pipes as was then already customary in England, although still unknown in Germany, another innovation derivative in character. In 1801 the Works was casting machine parts, especially for spinning machines; and machine parts, in addition to structural iron, found a ready sale then and later to Saxon salt works, mines, forges, and mills. To be sure, there was brisk competition on the part of furnaces and forges in the Saxon Erzgebirge. In that same year, Lauchhammer began to produce for sale *Schrotmühlen* according to English models, probably heavy rolls for crushing iron scrap. All these operations provided the plants with the experience necessary for expanding this type of manufacture after 1816. It was, indeed, a promising switch indicating a high degree of foresight. The Lauchhammer enterprise adapted itself at an early moment to the needs of the coming industrial order. When it reached its hundredth anniversary the foundation was being laid for another hundred years of operations.

However, there was developed in the late eighteenth century still another line of the Lauchhammer Works' foundry business which has not even been touched so far and which is not reflected in the table. It has been mentioned before that in the Löwendal era the casting of utensils had been neglected. Whatever was cast, was cast in loam or in open sand molds (hearth molds). Hardly had success been achieved in the casting of statues when the Works expanded its activities in the former field and changed its production method. The casting in sand boxes was taken up in 1785, casseroles being the first objects so cast, others were stoves, mortars, and pipes; pots followed in 1789. In the early nineteenth century the plant was taught, supposedly by an Englishman, to cast in wet sand, the molds having previously been dried. (Structural and machine parts were in that period always cast in open sand molds.) One gains the impression that casting in sand boxes expanded at the expense of casting in loam, but the latter was not entirely abandoned. In 1814 the Works built a contrivance, de-

signed by the previously mentioned mining official Brendel, for preparing the loam; and loam casting was expressly mentioned for 1822.

But this is only the minor part of the story. Hardly had Count Einsiedel devoted attention to the casting of utensils when with the help of a chemist, called in as an adviser, he brought into existence another primary innovation. The Lauchhammer Works succeeded in 1785, *i.e.*, only one year after the first statue had been cast, in enameling utensils, which means that a thinly fluid colored silicate was melted on the cast-iron utensil.[25] As the sources indicate, that had never been achieved before in Europe, and the Lauchhammer Works—finding in the 1820's imitators among a few German enterprises—remained, together with the latter, for many years in the vanguard. It is claimed that as late as 1828 neither English nor French factories had solved the technical problem. The Lauchhammer Works probably used as base crushed quartz melted with borax (sodium borite), a mass which was ground with cleansed clay added, while the enamel proper consisted of feldspar, borax, sodium carbonate, and a little tin oxide.

In 1786 we find enameled casseroles offered in sets of twelve, including four large, four medium, and four small sizes, at 9 *Reichstaler*, or separately the four large ones at 3 talers and 18 groschens, the medium ones at 3 talers and 12 groschens, and the small ones at 2 talers and 18 groschens. But it seems that only after the Wars of Liberation was the mass production of enameled utensils started and the market really opened up. The Lauchhammer *Festschrift* of 1925 has reproduced one page of a catalogue of that period which shows that thirty-eight sizes of enameled pots alone were then sold, ranging from ⅛ quart or ½ pounds at 2 Prussian talers and 5 groschens to 23 ½ quarts or 26 pounds at 2 talers 1 groschen and 9 pfennigs. Those up to four quarts were delivered with or without spout and the larger ones with one or two handles and with spout.[26]

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[25] The technical process used in the period has been described as follows: with the help of a fine sieve powdered enamel was brought on the red-hot object which was then put into the furnace again, a process which was repeated several times. Only the inside of the utensils was enameled while the edges and the outside were blackened with soot, graphite or mineral color.

[26] For the preceding, see *F.*, 25; *F. of 1925*, 20, 21, and the plate after p. 20; Beck, *op. cit.*, III, 903; IV, 246; Bertuch, *op. cit.*, 372. The University of Würzburg (unprinted) thesis of 1922 by Bellino, *Das Deutsche Kunst- und Gebrauchsemaillier-gewerbe, seine Entwicklung und seine volkswirtschaftliche Bedeutung* is not available in America. But Frau Hermann Kellenbenz, Dietramszell, very kindly

The production of wrought iron and wrought-iron articles did not change much in the era of the elder Einsiedel at least not radically. New products were nails, tools, and files, the manufacture of which started in 1777 and 1785. In the latter year two workers were hired to make the files.

Although we do not know at which moment of its history the Lauchhammer Works turned in this direction, in the era of the elder Einsiedel, at least, it became a high-quality producer. The administration itself assigned this success to certain measures, to be cited in another context. The greatest achievement, the founding of objects of art, was predicated on this aspect of the Works' production, as was that of enameled utensils. No one but a producer accustomed to rigid qualitative requirements would have been able even to try those innovations. What held true of cast products, became equally true of forged ones. Trautscholdt proudly reported that in 1816-17 the Works delivered to the Saxon government 302 forged artillery axles, of which only seven failed to stand the severe tests to which they were subjected. Incidentally, after the Lauchhammer Works had become Prussian it gained the Prussian artillery as a new customer while retaining its old one, the Saxon. I might stress parenthetically that the Saxon prime minister of 1825 was in private capacity a producer of armament, both for his own and a neighboring country with which Saxony was not on the best terms at that time.

IV

VOLUME OF PRODUCTION AND OUTPUT

The presentation of the Lauchhammer Works' production and output in quantitative terms is for various reasons beset with difficulties. First, measures and weights were in the eighteenth century in Germany still local affairs, and it is impossible for an author in America to translate them into modern Anglo-Saxon or metric terms with such exactness as would be desirable. All such figures as are given here must be considered approximate while reliably indicating the magnitudes involved. Secondly, in the course of the Lauchhammer Works' production some raw materials were weighed and others measured,

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copied those sections of the thesis which deal with our subject. They are technical in character and the description in footnote 25 of the process of production has been taken therefrom. Frau Kellenbenz's kindness has been much appreciated.

and it has been difficult to bring the different weights and measures on a satisfactory common weight denominator. For example, in charging the blast furnace one weighed limestone, but measured coal and ore, in fact with two different measures. Moreover, only if we knew the chemical composition of the ore used, could we determine the exact weight. Since we do not, it is necessary to rely on Lampadius who gives the weight of two *Dresden Scheffels* of ore as equal to 5½ *centners* and that of 1 *Kübel* of charcoal as equal to 1½ *centners*. (*Dresden Scheffels* and *Kübels*, respectively, were the volume measures used for ore and coal.)[27] Thirdly, to make things worse, Trautscholdt's comments on some computations, presumably understandable to historians of technology, are not intelligible to the economic historian, who in still other cases has grave doubts as to whether or not double counting has been avoided. This is especially the case when Trautscholdt reports side by side figures for output of crude, cast, and wrought iron.[28] Regardless of all these difficulties it is hoped that the figures selected will give a sensible picture of the character and development of the enterprise.

Let us begin by studying the Works' early production of crude iron. The first furnace run started on August 25, 1725, and lasted twenty weeks. (It may be added in passing that by the end of the Löwendal era and in the early nineteenth century the duration of the Lauchhammer furnace runs had been increased, so as to approach 30 and 50 weeks, respectively, a very satisfactory improvement.) Our source reports that during the first run a little more than 2,771.50 *centners* of crude iron were produced. That weight measure, used at Lauchhammer, will be cited consistently: 1 *centner* is equal to 123.48 American pounds avoirdupois and approximately the equivalent of the British hundredweight (cwt). For producing the above quantity of crude iron the following raw materials were used:

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[27] Lampadius, *op. cit.*, 315.

[28] When crude iron is produced with charcoal there is no clear dividing line between such crude iron as is used for casting and such as goes to the forges. This is generally known, and on top of that the report of 1782 of a high Prussian mining official expressly stated that the Lauchhammer Works did not differentiate between iron for casting and forging. Consequently we should be sure that the item "foundry iron" contains only such crude iron as was used in casting and that those quantities which were sent to the forges were deducted from the total of crude iron. But it is not certain whether in our source the terms foundry (cast) iron and crude iron were actually kept consistently separate.

iron ore 3,050 *Dresden Scheffels*	or about	8,387.5	*centners*
charcoal 4,164 *Kübels* (=4*Scheffels*)	" "	6,246	*centners*
limestone		315	*centners*

This table gives an idea of the quantities of raw material moved in that first furnace run: they were about five times as heavy as the output.

In addition, our source has provided us with the most interesting cost computation for this first Lauchhammer furnace run. The abovementioned (exactly) 2,771.54 *centners*, produced in the course of that run, cost 1,925 talers, 4 groschens and 8 pfennigs, that is to say 16 groschens and 8 pfennigs per *centner*.

However, before the computation is presented it is necessary to give a somewhat lengthy explanation. The books of the Lauchhammer Works were posted in talers, and those talers seem to have been Leipzig money of account (1 taler = 24 groschens, 1 groschen = 12 pfennigs). This taler was figured from 1733 - 1763 at a rate of 15.475 grams of fine silver and from 1763-1810 at a rate of 17.844 grams. In the latter period the money of account was worth roughly three-fourths of the actual coin in circulation, the *Reichstaler* or *Konventionstaler* of 32 groschens, containing 23.925 grams of fine silver. This name was derived from the conventions between Austria and a number of German states agreeing in the middle of the eighteenth century on that standard. However, after 1810, or at least at the time when the Lauchhammer Works became Prussian, the Prussian taler became the standard coin in the area, and it had a silver content of 16.704 grams. It must be understood that while prices are given in this paper in either *Reichstalers* or Prussian talers, all quotations from the Lauchhammer books are in Leipzig money of account.[29]

That much must be known to understand what the figures in our cost computation mean. Of course, it is not a correct computation from the modern point of view. The following items are not considered, although they would have belonged in a complete schedule of costs: amortization of the mines, amortization of fixed capital, interest, taxes, if any, and the cost of replanting the trees cut for the production of charcoal. But, of course, correct cost computations

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[29] See Moritz Elsas, *Umriss einer Geschichte der Preise und Löhne in Deutschland*, II (Leiden, 1940), 12.

were still unknown by 1725, and these items were just omitted.[30] Of those which are to be found, equipment (probably used up in this one process of production) amounted to 5.5 per cent, raw material to 78.5 per cent, and wages to 15.9 per cent of the total.

The year 1733 was the first during which the forges worked to the satisfaction of those concerned, and the following output was recorded:

Oberhammer	about	760.25	*centners*	bar iron	
Mittelhammer	"	769.5	"	"	"
Unterhammer	"	409	"	"	"
Grünewalder Hammer	"	10	"	"	"
		47.75	"	iron for tools	
		240.75	"	iron rods	
Total	"	2238	"	wrought iron	
or	"	110 long tons		"	"

In this production 8 *centners* of crude iron were used for bringing out 5 *centners* of bar iron, but some of the loss was recovered by remelting the forge cinders in the furnace. Since in the course of the second furnace run (September, 1726 to February, 1727) 436 objects had been cast in loam and sand weighing an estimated 20 *centners* or about one long ton, and since in 1733 the production of cast objects would hardly have been smaller than that of the above seven months in the 1726/27 run, we possess a reasonably accurate picture of the Lauchhammer Works' production in the early years of Freifrau von Löwendal. For the whole of the Löwendal era 200 long tons are supposed to have been the average yearly crude iron output and 90 long tons that of wrought iron,[31] consuming part of the crude-iron output.

In 1782, a few years after the elder Count Einsiedel had taken over but before he had started developing the enterprise, the Works was visited by two high Prussian mining officials, one of whom reported that the Lauchhammer Works produced about 160-200 *centners* of crude iron per week, which in consideration of an estimated forty-

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[30] It seems to have been typical of seventeenth and eighteenth-century accounting, as practiced on estates, that depreciation was not considered; see Otto Brunner, *Adeliges Landleben und Europäischer Geist. . .* (Salzburg, 1949), 301.

[31] The figures for total production in the Löwendal era, given by Trautscholdt on page 11, tally with those given on page 46, but the tabulation on pages 45-46, besides containing a bad misprint, does not make sense without knowing Trautscholdt's terminology in all detail. But there is no clue to that terminology which in some respects appears inconsistent; this is not surprising for a businessman

weeks' furnace year may have amounted to about 7,200 *centners* or about 360 long tons a year, as compared with the 200 tons average in the Löwendal era. Simultaneously the wrought-iron production was

TABLE 2

COST COMPUTATION FOR 2,771.54 *Centners* OF CRUDE IRON PRODUCED IN TWENTY WEEKS BETWEEN AUGUST, 1725, AND JANUARY, 1726
(expressed in talers, groschens, and pfennigs of Leipzig money of account)

Equipment	t.	gr.	pf.	
furnace hearth (used up in the run)	60	..	..	
minor material				
3 copper molds	20	16	9	
bar iron	15	..	..	
other, incl. 40 lbs. tallow at 1 groschen per lb.	6	16	..	
repair of the bellows	6	..	..	
total equipment				108.8.9
Raw Material				
3,050 *Dresden Scheffels* bog ore	656	8	10	
4,164 *Kübels* (= 6,246 *centners*) charcoal at 11 talers for 90 *centners*	763	9	..	
loam for casting (digging and transport)	1	..	..	
315 *centners* limestone	90	..	..	
total raw material				1,510.18.5
Wages				
carpenters	3	..	..	
head furnace worker for 21 weeks, 4 shifts at 2 talers per week	43	3	6	
furnace worker at 1.18 per week	37	18	..	
trip for the two (obviously in-migrants)	2	..	..	
tips	4	..	..	
beer money for the two [a]	2	12	..	
two skilled hands for charging the furnace (*Aufgeber*, "fitters") at 2 and 2½ talers per week for the two	46	..	..	
wages of unskilled helpers	35	..	..	
salaries for supervisory employees and wages for measuring the charcoal	131	16	..	
wages and incidental costs of a smith	1	..	..	
total wages				306.1.6
Total Cost				1,925.4.8

[a] In the eighteenth-century English Kirkstall forge all workers got "two drinkings" per day; see [Rodney Butler], *The History of the Kirkstall Forge through Seven Centuries, 1200-1945 A. D.* (Kirkstall, 1945), 18.

reported as amounting to about 200 long tons per annum at a cost of 4 talers, 8 groschens per *centner*.[32] If these figures for the Works' wrought-iron production are correct, as they probably are, and we assume a 25 per cent loss on the amount of crude iron used as raw material,[33] we arrive at the conclusion that about 270 long tons of crude iron were used in the wrought-iron production. How much of the loss was recovered in remelting the forge cinders is not known.[34] But the difference between 360 long tons of crude iron produced and 270 long tons of crude iron consumed indicates approximately the magnitude of the production of cast-iron products during the early 1780's.

The situation had entirely changed by the first decade of the nineteenth century. In that decade emphasis was on the output of cast-iron products. Lampadius reported for that period that the weekly crude-iron production amounted to more than 200 *centners;*[35] assuming for that period a furnace year of forty-five weeks and an average weekly output of 225 *centners*, we arrive at a yearly crude-iron production of about 500 long tons. According to Lampadius there were three castings every day, the iron being taken from the hearth with ladles. In between, when the slag was tapped, iron was taken from the hearth for the casting of small objects. Only on Sunday was the furnace tapped to make available that crude iron which was used in the forges. But it seems that this picture is overdrawn, as can be seen from Table 3 giving the total crude-iron and wrought-iron production in the twenty-nine years of the elder Einsiedel.

TABLE 3
TOTAL PRODUCTION, 1776-1804
(in *centners*)

				Annual
"geschmolzenes Eisen"	Lauchhammer	Burghammer	Total	Average
(probably crude iron)	239,973	38,331	278,304	
wrought iron	122,836	19,380	142,216	
	or expressed in long tons			
crude iron	11,998	1,917	13,965	481
wrought iron	6,142	969	7,110	245

The average wrought-iron production was so high that the his-

[32] *Stahl und Eisen*, XXV (1905), 1231, 1232.

[33] For this estimate, see Beck, *op. cit.*, III, 393, 397.

[34] This slag also contained some limestone; 5-8 pounds of limestone were added to a *centner* of crude iron in the process of refining it.

[35] Lampadius, *op. cit.*, 313, 314.

torian cannot believe that Sunday tappings provided all the crude iron which the forges needed. Maybe there were also nightly tappings which Lampadius overlooked. The annual average output of cast-iron products amounted in the period of the elder Einsiedel to 160 long tons, but we do not know if that figure includes the Burghammer production. If one holds the various figures together there remains a difference, unaccounted for, of about 80 tons per annum. Part of that would have been lost in the forges, part would have been used for building up larger stores, but there would still remain a considerable difference which could not be explained. Is the production of cannons and ammunition left out perhaps and contained in the unaccounted-for figure? Can one venture the guess that in this period the value of the cast-iron products outran that of the forge products?

In the first twenty years of the younger Einsiedel's administration (1805-1824) the concern's total production has been given as follows:

"geschmolzenes Eisen" (roughly crude iron)	*centners*	long tons	an. av. long tons
Lauchhammer	260,476	13,014	650.7
Gröditz and other cupola furnaces	9,092	455	22.8
Burghammer	90,003	4,500	225.0

These figures are not satisfactory; the first and third lines show the production of the Lauchhammer and Burghammer blast furnaces and refer to crude iron. The second line, however, shows the production of the cupola furnaces, mainly of that in Gröditz but also of those in Lauchhammer. As to Gröditz, we know that in the years concerned, not having a blast furnace, the plant melted scrap iron in the cupola furnace and worked it into wrought iron. The exact amount of its production is unknown and that actually appearing in the above tabulation under the head "Gröditz" contains an unknown quantity which is already entered in line 1 under Lauchhammer furnace production (Lauchhammer's pigs were remelted in the cupola furnace for foundry purposes). That means that the total average is too high. The following may be a realistic picture: the average annual production (1805-1824) of crude iron in all plants together may have been about 875 long tons per annum, to which must be added another few tons made available through the smelting of scrap at Gröditz. The grand total will have remained under the average of 900 tons per annum. But since the period 1805-1824 included the war years, in which production

probably fell off, since Saxony as an enemy of the allies could not produce armament and ammunition, the total yearly production of crude iron and melted scrap iron may have amounted to as much as 1,000 tons in 1824.

The figures reported for wrought iron are more sound:

	centners	long tons	an. av. long tons
Lauchhammer and Grödlitz	106,993	5,350	268
Burghammer	52,730	2,637	132
Total	159,723	7,987	400

In comparing the last figure of 400 long tons of wrought iron with that of 900 tons of crude and remelted scrap iron we can draw a conclusion as to the output of cast-iron products. After the Wars of Liberation the latter seems to have outrun that of wrought iron. This implied a reversal of the original production policy, foreshadowed already in the second period. How much of the difference between crude and wrought iron produced was taken up by the manufacture of gun tubes and ammunition is entirely unknown and it is also unknown by which amount the crude-iron store was increased between 1805 and 1824. As in the case of crude iron, the wrought-iron production was in 1824 undoubtedly above the average, probably anywhere between 400 and 500 long tons.

The preceding findings and estimates can thus be characterized: although they are not exact, they show clearly both the magnitude of the production and the trend.

We can now turn to the last aspect of the Lauchhammer Works' production, its efficiency, as expressed in figures. In this connection we possess an interesting bit of information which indicates the formula according to which the furnace was charged in the 1790's and 1800's. Bog ores are a variety of limonite, the latter being hydrated ferric oxide ($2Fe_2O_3 3H_2 0$). The ores from the various deposits used in Lauchhammer had a content varying between 35 and 45 per cent of ferric oxide.[36] To 60 standardized wheelbarrows of well-mixed ore were added 5 to 7 wheelbarrows of limestone (the wheelbarrow's content of limestone weighing 1.25 *centners*). The charge proper con-

[36] Lampadius' table (*op. cit.*, 302, 303) is not clear. I think his percentages refer to ferric oxide.

sisted of 14 to 15 "*Kästchen*" (literally translated: little boxes) containing 40 pounds of ore-limestone mix; *i.e.*, each charge was 5.8 *centners* of the mix plus two *Kübels* = 3 *centners* of charcoal.[37]

There were two main criteria of efficiency, the amount of iron produced from a given quantity of ore, and the amount of charcoal used per given quantity of output (either crude iron or wrought iron). But the yield figures for iron relative to the unit of 10 *Scheffels* of ore are not satisfactory for purposes of comparison, because the ores melted in the Löwendal era (1725-1776) were richer than those melted later, and only if related to the actual content of ferric oxide in the unit of ores would yield-figures be telling. The following figures are reported:

			centners of iron
Löwendal era	average yield on 10 Dresden *Scheffels* ore	=	11 3/8
Einsiedel, Sr., era	" " " " " " "	=	10 16 25
Einsiedel, Jr., era	" " " " " " "	=	10 16/20

(Unfortunately the microfilm used for this study is so poor that even with a magnifying glass the fractions are not clearly readable). Trautscholdt stressed proudly that on an average the yield was 16 pounds higher in the years 1805-1824 (the period of the younger Einsiedel) than it had been in 1776-1804 (the period of his father). This implies that he must have considered the quality of ore equal in both periods, as it probably was. On the basis of analyses, ores were judiciously mixed before they were melted.

We are much better informed on the use of charcoal per unit of product. In this case the saving is obvious, and assuming that Trautscholdt was right and there was also a better furnace yield, production costs must have shown a downward trend. During the very first furnace run (of 1725) 2.25 *centners* of charcoal were needed for 1 *centner* of crude iron produced and the coal consumption in the forges was at that time still higher, namely 3.75 *centners* of charcoal per *centner* of bar iron produced. During the Löwendal era the furnace masters had succeeded in bettering the ratio from 2.25:1 to 1.9:1; in 1804 it was 1.55:1 and this ratio had further dropped in 1825 to 1.33:1. Corresponding figures for the forges are not available. But Beck has compiled a table showing charcoal consumption per unit of wrought iron produced in a number of eighteenth-century iron enterprises.[38] If we take from that list only the figures referring to German

[37] Lampadius, *op. cit.*, 312; Beck, *op. cit.*, III, 904.

[38] *Ibid.*, III, 681.

works, we find them ranging between 573 and 770 units of charcoal for 100 units of wrought iron *produced from ore*. That is to say, these figures include charcoal used both in the furnace and in the forge. In this list Lauchhammer stands with 629 units at a place indicating efficiency; Burghammer with 712 units is less well placed. But those figures do not mean too much since charcoal consumption depended in part on the kind of ore melted and the quality of iron forged.

How important savings of charcoal were, is evident from the following figures: in the Löwendal era the plants consumed an average of about 2,400 *Klafter*[39] (approximating more than 2,500 cords) of wood per annum. This amount of wood could be produced from about 150 acres of forest land if one-fifth of the timber was taken and replanted every twenty years. The total wood consumption in the twenty-nine years of the elder Einsiedel amounted to 190,215 *Klafter* or about 200,000 cords, while the first twenty years of the younger Einsiedel saw a total consumption of 118,758 *Klafter* or about 125,000 cords. Reduced to annual average figures the consumption was more than 6,000 cords per year; for the early 1800's Lampadius gives the annual consumption as 8,000-9,000 *Klafter*.[40] However, it must be kept in mind that the annual average figures are not strictly comparable: In the Löwendal era charcoal was used for all purposes; beginning in the era of the elder Einsiedel and increasingly in that of the younger, charcoal was replaced by other fuels, especially peat and gas produced from peat. Unfortunately we do not possess figures showing the consumption of fuel other than charcoal [wood]. Through the progressive replacement of charcoal and through the saving of fuel the demand of the furnaces and forges could be satisfied during the Works' first hundred years. But the distances over which charcoal was carted to the plants became larger and larger and consequently its cost became higher and higher. Charcoal was finally brought over distances of ten to twenty miles.[41]

TO BE CONTINUED

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[39] It is hardly possible to give in America the exact counterpart of this figure expressed in cords of 128 cubic feet. Eighteenth-century measures varied from locality to locality. The *Klafter*, for example, varied between 80, 126, 144, and 150 cubic feet; 144 cubic feet was the usual size of the *Klafter*.

[40] Lampadius, *op. cit.*, 303.

[41] This paragraph is based to a certain extent on the competent presentation in *F. of 1925*, page 15, but I think the ratio for 1804 was 1.65:1.

FINANCING ILLINOIS INDUSTRY, 1830-1890

Where did the owners of early Illinois industries get the capital and the funds to start their factories? What was the background of these early manufacturers? The evidence that will be presented here suggests that the typical Illinois manufacturer of the nineteenth century was a self-financed man who was born and raised in Europe or on the eastern seaboard.

Let us begin with the basic thesis of Frederick Jackson Turner, Wisconsin and Harvard historian of the last generation, who reinterpreted the history of this country. Turner's thesis, enunciated at the Chicago meeting of the American Historical Association in 1893, was that society was reborn on every new frontier. Its character was influenced not only by heredity but even more by its new environment. Thus the American economy reflected not only European, especially Anglo-Saxon customs and institutions brought across the Atlantic, but it also reflected the pioneer's adaptation to primitive frontier conditions. By the second, third, and fourth generation, Americans had forgotten or abandoned certain European ways because these were not adapted to survival in the New World. On the frontier, corn replaced wheat, Indian canoes replaced wagons, and, after the seventeenth century, log cabins replaced frame houses. Men ceased being craftsmen or even just farmers, and became jacks-of-all trades if they lived far from towns. What was true of the coastal regions in the seventeenth century was true of the Piedmont before the Revolution, and of the Midwest in the early nineteenth century. As the years passed and more people flowed into that region, and cultivated or improved it, the Midwest economy became more complex and sophisticated, like any older society, but with some different characteristics because the environment was different.

Turner used the words of J. M. Peck, author of an *Emigrants' Guide* (1837) to describe the maturing of the West. Peck had written,[1]

> Generally, in all the western settlements, three classes, like the waves of the ocean, have rolled one after the other. First comes the pioneer .... His implements of agriculture are rude, chiefly of his own make, and his efforts directed mainly to a crop of corn and a "truck patch" .... A log cabin, and occasionally

[1] F. J. Turner, *The Frontier in American History* (New York, 1920), pp. 10-21.

> a stable and corn-crib, and a field of a dozen acres, the timber girdled or "deadened," and fenced are enough for his occupancy .... The next class of emigrants purchase the lands, add field to field, clear out the roads, throw rough bridges over the streams, put up hewn log houses with glass windows or stone chimneys, occasionally plant orchards, build mills, schoolhouses .... Another wave rolls on. The men of capital and enterprise come. The settler is ready to sell out and take advantage of the rise in property.... The small village rises to a spacious town or city; substantial edifices of brick, extensive fields, orchards, gardens, colleges, and churches are seen. A portion of the first two classes remain stationary amidst the general movement, improve their habits and conditions and rise in the scale of society.

Turner's thesis and the quotation just cited are familiar to many of you. I repeat them here because they are so basic to the story that I have to tell. It is the second wave, with its mills, and especially the third, with its "men of capital and enterprise" which will concern us.

The investigation is limited to Illinois because that is in the heart of the Midwest and contains Chicago, the region's greatest city. There are other limitations. The years 1830-1890 are those when Illinois was in the end of the second stage and in the less complicated beginning phases of the third stage. It was also the heyday of laissez faire. The investigation is also limited to persons, or family groups that have actually founded an industry, not bought one out (with a few exceptions). Finally it is concentrated on industries that reached the factory stage. Factories hire several persons, they use some non-human form of power, and they produce goods for sale in the general market. It is within these limitations that information has been obtained on 50 enterprises run by 57 individuals. (See Table 1.)

These are not the most important 50 manufacturing enterprises in Illinois in this period by any criterion. Many famous names are missing, many relatively inconsequential ones are included, although not without reason.

It will be asked, "How did you go about selecting the industries and finding the information?" The first step was to consult the index volume of the *Dictionary of American Biography* and get a list of all famous American manufacturers. Incidentally, there were relatively few from the Midwest in there. There were about 35 from Illinois, and 25 of them were usable. Thus about half of the 57 manufacturers were famous enough to be included in this all-time American "Who's Who." Harvard University's Graduate School of Business Administration issues a booklet entitled *Business Biographies and Company Histories.* That listed a number of full-length biographies of Illinois

leaders. Some of them were of persons already listed in the *Dictionary of American Biography*. Personal inquiries yielded two more, such as William Besley, Waukegan brewer, and Oscar Mayer, Chicago meat packer. The sources cited in the *Dictionary of American Biography* were in very considerable degree newspaper obituaries and county biographies. That suggested another logical source.

Consequently, the next step was to consult several county biographies published between 1880 and 1905. They contained the names of men of the period 1830-1890. To a large extent these were lesser personages in the world of manufacturers—small businessmen so to speak. That provided good balance for the famous names taken from the *Dictionary of American Biography*. The fact that the men listed in the county biographies generally paid to be included caused no harmful bias. But Illinois has over 100 counties; which should be chosen? The Census of 1850 revealed that the seven leading counties from the viewpoint of manufacturing were, respectively: Cook containing Chicago, Peoria along the Illinois River, Madison containing Alton and not far from St. Louis, Jo Daviess in the north containing Galena and its lead mines, Adams in the west containing Quincy, and Fulton, also along the Illinois River containing Canton, and Kendall which is a little west of Chicago.[2] Suitable county biographies were readily available for four of these: namely, Cook, Peoria, Jo Daviess, and Fulton. From them 30 names were selected. They were chosen because of the relative adequacy of information provided about finances. There was also some overlapping with the previous lists.

What was Illinois like in this period 1830-1890? Again let us take 1850, a year when the median person of my list of manufacturers was 19 years old. The population of the state was then 846,000. The largest town was Chicago, with 30,000, and it was growing so fast that it had reached 60,000 in 1853. Quincy and Galena had about 6,000 each, and there were roughly a dozen others with over 1,500.[3] Chicago was so sleazy and muddy that William Besley, disgustedly passed it

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[2] Cook, $1,068,000; Peoria, $419,000; Madison, $332,000; Jo Daviess, $288,000; Adams, $260,000; Fulton, $255,000; Kendall, $244,000; and next, LaSalle, $160,000. J. De Bow, *Compendium of Seventh Census* (Washington, 1854), p. 223.

[3] Quincy, 6,900; Galena, 6,004; Peoria, 5,095; Springfield, 4,533; Peru, 4,500; Alton, 3,585; Ottawa, 3,219; LaSalle, 3,201; Joliet, 2,659; Elgin, 2,359; Aurora, 1,895; Bourbonnais, 1,710; Rockford, 1,711; Pekin, 1,678; Bloomington, 1,594; Freeport, 1,436. *Compendium*, pp. 338 ff.

by and went farther north to Waukegan to settle.[4] George Pullman (later manufacturer of sleeping cars) made quite a reputation lifting the foundations of important buildings that had sunk into the mud. There were almost no railroads, but a great one was constructed in the next six years.[5] This was the Illinois Central, a Y-shaped system radiating from Centralia in central Illinois northwest to Dubuque, Iowa, on the Mississippi, northeast to Chicago, and south to Cairo where the Ohio joins the Mississippi. It would open the fertile Grand Prairie in the central part of the state, where as yet very few people lived.[6]

The largest age group of people living in Illinois in 1850 were those between the ages of 20 and 30. Most people were farmers.[7] Manufacturing was in its infancy. The 1850 census mentions 3,164 establishments, with a total capital of $6,400,000 and 12,000 employees. These establishments had produced products worth $17,000,000 in 1849.[8] Some of the chief products were beer and whiskey, iron and iron castings, and woolens. In the villages the most frequently encountered industries were gristmills and sawmills. This will give some idea of Illinois a century ago. The population of the whole nation was then 23,000,000, a war had recently been won, another was in the making, and a general lived in the White House.

Perhaps, too, a word should be mentioned about the development of Illinois by 1890. Its population had quadrupled; Chicago now had 1,000,000, Peoria 40,000; Illinois had risen from fifteenth to third in importance in manufacturing. The leading industries were now agricultural implements, the manufacture of illuminating gas, meat packing, iron and steel, and foundries and machine shops, in that order. Also important were malt liquors, preparation of lumber, and flour milling. The leading manufacturing counties were Cook, still by far the most important with manufactures of $363,000,000 in 1889, and

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[4] William Besley was the great grandfather of the author's wife. This was the family tradition, related by Besley's granddaughter, Mrs. Jane B. Strong.

[5] There was one road in the west from Naples to Springfield, another in the north connecting Elgin, Aurora, and Chicago.

[6] The 366-mile route, Chicago to Cairo, passed *near* three settlements of importance; Bourbonnais on the Kankakee River (710), Urbana on the Grand Prairie (210), and Jonesboro in the south (584). Carlton Corliss, *Trails to Rails* (Chicago, 1937), p. 25.

[7] *Compendium*, p. 52.

[8] *Ibid.*, pp. 128-9, 179-82.

Peoria, a poor second, with $15,000,000. Rock Island, Kane, Will, and LaSalle Counties came next. Fulton, Madison, and Adams Counties still ranked high but Jo Daviess no longer did.[9]

In picking 50 firms a chief problem was to find those on which some information could be obtained. The birthplace of the founder, data on how he got his capital, the nature of the industry, and its first location were recorded. The 50 industries represent, to some degree, a sampling of Illinois industries and industrialists of this period. (See Table 1.) Admittedly, several hundred would have been a better sample.

TABLE 1

ILLINOIS MANUFACTURERS, 1830-1890

No.	Name	Birth Date	Birthplace	Business	Began manufacturing in Illinois
1.	Samuel Allerton	1828	New York	Meat packer	Chicago, 1870 (?)
2.	Philip D. Armour	1832	New York	Meat packer	Chicago, 1863
3.	Gilman W. Avery	1835	New Hamp.	Furniture	Peoria, 1864
4.	William Besley	1808	England	Brewery	Waukegan, 1854
5.	John Bird	1837	Canada	Flour	Warren, 1875
6.	Jacob Bottenberg	1804	Maryland	Sawmill, flour	Vermont, 1839
7.	William W. Burson	1832	Penn.	Farm mach. & knit goods	Rockford, 1870
8.	Robert Burton	1781	England	Lead smelter	Galena, 1831
9.	John Deere	1804	Vermont	Plows	Grand Detour, 1840
10.	William Deering	1826	Maine	Harvesters	Plano, 1870's
11.	Ralph Emerson	1831	Mass.	Farm mach. & knit goods	Rockford, 1854
12.	Hubert Felrath	1828	France	Soda water	Peoria, 1868
13.	Peter Fortune	1834	Ireland	Brewery	Chicago, 1866
14.	Benjamin Foster	1828	England	Paper boxes	Peoria, 1872
15.	Elijah Gammon	1819	Maine	Harvesters	Batavia, 1861
16.	John W. Gates	1855	Illinois	Wire	Opp. St. L., 1880
17.	William Goldthorp	1812	England	Leadsmelter	Galena, 1834
18.	Ralph S. Greenlee Robert G. Greenlee	1848 1848	Penn. Penn.	Cooperage machinery	Chicago, 1863
19.	Charles F. Gunther	1837	Germany	Candy	Chicago, 1863
20.	Jacob Haish	1826	Germany	Barbed wire	DeKalb, 1876
21.	Charles Herendeen	1859	Canada	Bakery	Danville, 1892
22.	Gurdon S. Hubbard	1802	Vermont	Meat packer	Chicago, 1834
23.	Edward N. Hurley	1864	Illinois	Piston air drill	Chicago, 1896
24.	Benjamin P. Hutchinson	1829	Mass.	Meat packer	Chicago, 1858
25.	H. M. Kiefer	1830	Germany	Brewery	Peoria, 1870
26.	S. A. Kinsey	1827	N. Jersey	Brass f'dry	Peoria, 1870's
27.	John McArthur	1826	Scotland	Iron f'dry	Chicago, 1850 (?)
28.	Cyrus McCormick	1809	Virginia	Harvesters	Chicago, 1848
29.	James E. MacMurray	1865	Missouri	Steel hoops	Quincy, 1888 (?)

[9] *Report on Manufacturing Industries in the United States at the Eleventh Census* (Washington, 1890), Part I, 387-99.

No.	Name	Birth Date	Birthplace	Business	Began manufacturing in Illinois
30.	Charles Wesley Marsh	1834	Canada	Harvesters	Plano, 1863
	William W. Marsh	1836	Canada		
31.	Frederick Matthiessen	1835	Germany	Zinc, clocks	LaSalle, 1864
32.	Oscar Mayer	1859	Germany	Meat packer	Chicago, 1883
33.	Mathias Miller	1827	Germany	Brewery	Galena, 1857
	Joseph Miller	1829	Germany		
34.	Nelson Morris	1838	Germany	Meat packer	Chicago, 1859
35.	Frederick G. Niedringhaus	1837	Germany	Enameling	Granite C., 1860
36.	William Nitschke	1849	Wisconsin	Cigars	Peoria, 1871 (?)
37.	William Parlin	1817	Mass.	Plows	Canton, 1853
38.	Moses Pettengill	1802	New Hamp.	Plows	Peoria, 1835
39.	M. W. Powell	1831	Penn.	Roofing	Chicago, 1856
40.	George M. Pullman	1831	New York	Sleeping cars	Chicago, 1860's
41.	George M. Sargent	1830	Maine	Iron	Moline, 1870
42.	Albert G. Spalding	1850	Illinois	Sporting goods	Chicago, 1876
43.	Gustavus Swift	1839	Mass.	Meat packer	Chicago, 1877
44.	Henry Timken	1831	Germany	Carriages	Belleville, 1857
45.	Joseph T. Torrence	1843	Penn.	Iron	Chicago, 1876
46.	Franklin Whitcomb	1830	New York	Bricks	Des Plaines, 1868
47.	James W. White	1818	New Hamp.	Woolens	Hanover, 1845
48.	William Wilson	1838	Ireland	Corsets	Peoria, 1875
49.	Five Woolner brothers	1835-45	Hungary	Distillery	Peoria, 1870 (?)
50.	John S. Wright	1815	Mass.	Self-rake	Chicago, 1852

The 50 firms investigated were engaged in making 54 kinds of products. There were 11 manufacturers of farm implements, 7 meat packers, 5 manufacturers of iron and steel, and 4 brewers. The rest were scattered and included sawmills, flour mills, lead smelting (2 each), candy, soda water, zinc, sleeping cars, carriages, sporting goods, baking, bricks, cigars, corsets, etc. Half these factories made consumers' goods and half made producers' goods. Eleven of the latter produced farm equipment. (See Table 2.)

The raw materials used in these industries came largely from the farms of Illinois. Few of these industries required a high degree of engineering knowledge for their operation. Even so, as we shall see, they required more such knowledge than people raised and educated in the pioneer Midwest generally had. W. R. Warner, would-be producer of turret lathes in 1880 gave up manufacturing in Chicago and moved east, to Cleveland, where he could find skilled operatives.[10] Several other prominent men of Chicago moved east when they decided to go into manufacturing. Few of the 54 industries required a really large investment in capital equipment.

[10] *Dictionary of American Biography*, XIX, 470.

TABLE 2

TYPES OF PRODUCTS

Consumers' Goods Industries		27	*Producers' Goods Industries*		27
Brewery	4		*Farm Implements*	11	
Meat (packed)	7		Harvesters & Farm mach.	6	
Distillery	1		Plows	3	
Candy	1		Self-rake	1	
Sporting goods	1		Barbed wire	1	
Carriages	1		*Others*	16	
Knit goods	2		Iron and steel	5	
Woolens	1		Zinc	1	
Bakery	1		Enameling and stamping	1	
Furniture	1		Pullman cars	1	
Soda water	1		Sawed lumber	1	
Cigars	1		Lead smelter	2	
Corsets	1		Cooperage machinery	1	
Paper boxes	1		Brake shoes	1	
Flour	2		Bricks	1	
Clocks	1		Brass	1	
			Piston air drill	1	
			Grand Total		54

As might be expected, the firms were concentrated in the larger cities. Altogether 18 began in Chicago, 9 in Peoria, and 3 in Galena. The rest were scattered over the state, especially, of course, over the counties examined, but these counties were chosen in the first place because they were more industrialized than the others.

The 57 men were all born between 1781 and 1865, the median year being 1831. (See Table 1.) In fact over half were born in the years 1826-1837. The average age at which they embarked on manufacturing was 33. Thus the median plant, in this respect, began operations in 1864. The first began in 1831, the last in 1896. The majority began between the years 1855 and 1875.

One of the surprises in this investigation was the birthplaces of these 57 men. Altogether 23 came from Europe, 10 of these from Germany; 13 more came from New England, and 10 from the Middle Atlantic States; 4 were born in Canada and 2 in the South. (See Table 3.) Only 5 of the 57 were born west of the Appalachian Mountains. These five were all born after 1849.

Why were so few of these manufacturers natives of the Midwest? Most of our western states were settled by persons who moved in from the next state east or south. The Superintendent of the Census of 1860 wrote, "In thirty states out of thirty-four the native emigrants have chiefly preferred to locate in a state immediately adjacent to

that of their birth."[11] But most of these manufacturers came from Europe or New England or the Middle Atlantic States. The bulk of manufacturing of that era was in Europe and the Northeast. More and better schooling was available there. True, the formal schooling of the 57 men was far from impressive by modern standards, but it was considerably greater than pioneer children enjoyed. Several spoke with pride of their training in mathematics and mechanics. There may also be some relationship between the eastern origin of these men, their occupation of manufacturing, and the source of their capital. More will be said of that later.

TABLE 3

BIRTHPLACE OF 57 MANUFACTURERS

Europe		23	*Middle Atlantic States*		10
England	4		New Jersey	1	
France	1		New York	4	
Germany	10		Pennsylvania	5	
Hungary	5 (Woolner Bros.)		*Canada*		4
Ireland	2		Ontario	3	
Scotland	1		Quebec	1	
New England		13	*Southern States*		2
Maine	3		Maryland	1	
Massachusetts	5		Virginia	1	
New Hampshire	3		*The Midwest*		5
Vermont	2		Illinois	3	
			Missouri	1	
			Wisconsin	1	
					57

Where did the money to start these industries come from? Almost never did a man get all his funds in one way. Yet virtually always some one source or method seems more important than others. This may be called the primary method, the others the secondary method. There were eight different primary methods of getting funds. (See Table 4.) In 23 cases the men worked for hire at one or many jobs, saved their money, and finally started an industry. In 11 instances they accumulated the funds in merchandising. In 4 instances they started in a very small way, as, say, cigar manufacturer William

[11] *Eighth Census of the United States, Population* (Washington, 1860), p. xxxv. The four exceptions are as follows: Maine to Massachusetts, Maryland to Ohio, Mississippi to Texas, and Missouri to California.

Nitschke or baker Charles Herendeen, who plowed back their earnings and expanded their operations. Four others got money from selling their farms, 2 invested from a previous manufacturing business, 2 made money in the "Gold Rush," 3 clearly relied on the funds of partners, and at least one made his money in successful real estate speculation.

In no major case, with perhaps one exception, did the money come from borrowing or inheritance.[12] This is the record although it is hard to believe. Autobiographers in county biographies might perhaps be expected to omit that source. Possibly too, when money was borrowed, the lender took a lien on the business, or a share of it, as William Deering did, and then took over the business himself after a while. In other words, some lenders might have been disguised as partners.

Each man had not only one major method but one or more secondary methods of getting capital; two, on the average. What was a primary method for one man was a secondary method for another. Among the minor methods the following were most common. Altogether 26 plowed back their earnings, 15 saved funds from jobs in their younger days, 11 made money in merchandising, 29 had the help of partners, in or out of the family, 3 made money in real estate, 1 cornered the Chicago pork market, 1 borrowed, etc. (See Table 4.)

Let us next look at half a dozen case histories, each representing an important but different way of getting capital.

Gurdon Saltonstall Hubbard, born in 1802 in Windsor, Vermont, was one of Chicago's earliest manufacturers. He was a meat packer. He was apprenticed five years as a fur trader and was then put in charge of a trading station in Illinois. From that position he rose to be superintendent of the American Fur Company posts in this region, next he was admitted to a share in the company's profits, and finally he bought out the company's interests in the region in 1828. Then he began buying up surplus hogs to trade in Illinois frontier towns. He also shipped hogs east via the Great Lakes to Buffalo. Foreseeing Chicago as a meatpacking center he moved there in 1834.[13] There was a speculative boom in land going on and he became part owner of an 80-acre tract near the center of the town, and then sold half of it for

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[12] A. W. Harris, pamphlet on William Deering in University of Illinois Library, p. 10, W. Deering to Elijah Gammon.

[13] *Dictionary of American Biography.*

$80,000.[14] In partnership with others he built a warehouse and packing plant.

Hubbard got his start with funds from his services to the fur company. Secondarily, funds also came from his hog-marketing activities, his real estate successes, and the help of his partners. All this capital, except perhaps the last, originated in Illinois as far as Hubbard was concerned.

TABLE 4

METHODS OF GETTING CAPITAL

Methods	Primary	Secondary	Total
Saved money from various previous employments	23	15	38
Started very modestly and plowed back profits	4	26	30
Had the help of partners, in or out of his family	3	29	32
Accumulated funds in trading and merchandising	11	11	22
Accumulated funds in another manufacturing venture	2	5	7
Got capital by selling his farm	4	2	6
From the Gold Rush	2	1	3
Successful real estate speculation	1	3	4
Family help or inheritance		1	1
Borrowed		2	2
Cornered the pork market in Chicago		1	1
From inventions		5	5
Betting		1	1
TOTAL	50	102	152

John Deere, farm machinery manufacturer, exemplifies the manufacturer who began on a small scale, plowed back his earnings, and enlarged his business. Born in Rutland, Vermont, in 1804, he grew up in Middlebury. He went to college only briefly and then became apprenticed to a blacksmith. After his apprenticeship, he worked by the day for the next 10 years, traveling out from Middlebury. An acquaintance of his went west to the Galena lead mines. He liked Grand Detour in north central Illinois and went back to get some friends and his father-in-law, Major Andrus, to join him. Andrus ran

[14] Neil M. Clark, *John Deere* (privately printed, Moline, Ill., 1937), p. 15.

a stage coach business and Deere often worked for him. Deere decided to join the expedition. He brought his tools with him and $73.73.

There was much for a blacksmith to do in Illinois. The farmers complained especially of the sticky soil. To operate a plow, a man needed two oxen and a paddle, the paddle to clean the moldboard every few yards. One day Deere thought of the smooth Sheffield steel saw in Major Andrus' sawmill and got an idea. He obtained a small amount of steel and made a self-scouring plow. He then sent to England for more steel. When the steel came, it was pitted from exposure to salt water and so he bought steel from Pittsburgh after that. Remember this was well before the days of cheap steel made by the Bessemer process. He made 10 plows in 1839 and 40 in 1840; he also added a second forge. In 1846 he turned out 1,000 plows, and then he moved to Moline on the Mississippi, where the transportation to market, the power resources, and the raw materials were more accessible. By 1857 he was producing 10,000 plows a year.[15] John Deere, plowmaker, literally plowed back his earnings. The other help he had was some capital from Major Andrus who was his partner for a time after 1843, and from two other partners after 1847.

Gustavus Swift, one of the last arrivals among the great meat packers, got his capital in trading. Born on Cape Cod, Massachusetts, in 1839, ninth in a family of 12 children, he worked for his brother, the village butcher, when he was 14. At 16 he wanted to go to New York but his father loaned him $20 to buy a heifer which he slaughtered and sold at a profit. Soon he was buying a steer every few days at the Brighton market outside Boston and peddling the meat in his red wagon in towns near his Cape Cod home. In 1859 he opened a butcher shop in Eastham, then in other villages. He had a brother or partner run his shops and he concentrated on the buying of cattle. He built up quite a reputation as a cattle trader.

In 1872 Swift formed a partnership with James A. Hathaway of Boston. He bought, and Hathaway slaughtered and packed. He noticed that better bargains could be found further west in Albany, and still better ones in Buffalo, and Chicago looked best of all. After 1874 he bought almost exclusively in Chicago and shipped east to Hathaway.

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[15] *Ibid.*, pp. 27, 43-44.

Swift was always very economy-minded and it irked him to pay for the cost of feeding cattle in transit, to see them lose weight, and then to throw half the carcass away in Boston. Why not slaughter in Chicago and ship dressed meat East? The idea became an obsession with him. That meant devising a refrigerated car. Hathaway thought that was impractical and the partners parted. Swift took $30,000 for his share of the business. In 1877 Swift went into the business of packing meat. His refrigerator car was, of course, a success; but that is another story. As late as 1885 he was still doing all the cattle buying himself and his firm was capitalized at $300,000. His business kept growing as he plowed back earnings. Also, he borrowed widely and continually. Swift paper was to be found in banks all over the state of Illinois and on at least one occasion he teetered on the edge of bankruptcy.[16]

From all this we may gather that Swift's capital came primarily from cattle trading and secondarily from plowing back profits, from having a Boston partner and from borrowing. After he was established, others invested in his corporation.

William Deering, another farm machinery manufacturer, got his capital primarily from merchandising. He became an Illinois manufacturer almost by accident. Born in South Paris, Maine, in 1826, he managed his father's woolen mill after he grew up. He also speculated in western lands in the 1850's. Next he went into the dry goods business, first as a retailer in South Paris, then with a partner in a commission house business with offices in Portland and New York. His health was not good and he was anxious to retire but he wanted to invest his surplus funds and the West seemed to offer opportunities. His boyhood friend, Elijah Gammon, together with a partner had bought the right to manufacture Marsh harvesting machines in six western states but Gammon lacked sufficient capital. Deering invested $40,000 in his plant in Plano, Illinois. There were financial and other difficulties and about 1870 Deering had to take over conduct of the enterprise.[17] In this case the capital came clearly from the East, from the profits of Deering's merchandising there. On the part

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[16] Louis Swift, *Yankee of the Yards* (Chicago, 1927), *passim;* Thomas W. Goodspeed, "Gustavus Franklin Swift, 1839-1903," *University Record* (Chicago, 1921), I, 171-86; *Dictionary of American Biography.*

[17] Historical *Encyclopaedia of Illinois*, Cook County, II (1905) 863-64; A. W. Harris, pamphlet on William Deering.

of Elijah Gammon the capital came secondarily if not primarily from borrowing.

Philip Armour, the meat packer, got the nucleus of his capital in quite another way. He was born in Stockbridge, New York, in 1832. At 20 he got the "gold fever" and went to California with a party of 30. They constructed sluices and mined gold on a moderately large scale. Armour made several thousand dollars as his share. He came East in 1856 and soon was in a partnership in a wholesale grocery business in Milwaukee. Then he formed the company of Plankinton and Armour, dealers in grain and meat. As the Civil War drew to an end, he foresaw a sharp drop in meat prices and sold pork short at just the right time. The price dropped from $30-$40 a barrel to $18 and Armour made $2,000,000. He began packing pork in Chicago in 1868.[18] In Armour's case the first capital came from his gold success, and then more was added from merchandising activities, speculating, and perhaps through the assistance of partners.

Cyrus McCormick, farm machinery inventor and manufacturer, had one of the most favorable backgrounds for manufacturing in his early youth. He was born in 1809 in Rockbridge county, Virginia. His father owned 1,800 acres of farm land, two grist mills, two saw mills, a distillery and a smithy and was a moderately successful inventor. His father's obsession was to invent a reaper, but he never succeeded. His son, Cyrus, however, was successful in 1831 but did little with the reaper at first. Then the Panic of 1837 bankrupted the McCormicks.

After that about all that Cyrus had left was his reaper patent which no one seemed to want. He sold his first reaper in 1840, 7 in 1842, 29 in 1843, and 50 in 1844. Then a friend said, "Cyrus, why don't you go West with your Reaper, where the land is level and labor is scarce?" He went West, he saw the prairies, in fact he saw hogs turned into fields of ripe grain because there were no laborers to gather it.[19]

About this time Cyrus McCormick's father died. Also his patent was running out and if he was to make money on reapers, he would have to make all of the machines himself instead of leasing his patent rights to other manufacturers as he had been doing in part. He decided to start manufacturing in Chicago. A former lessee of his patent rights, Charles Gray, owed him money but had credit in Chicago and

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[18] *Dictionary of American Biography.*

[19] H. N. Casson, *Cyrus Hall McCormick* (Chicago, 1909), p. 65; *Dictionary of American Biography.*

a small plant and knew that to be a promising market. McCormick and Gray went into partnership, with the expectation that Gray would put up most of the money. McCormick had some funds, however, for he had made $9,000 the year before. There was a misunderstanding; Gray thought McCormick had not fulfilled his part of the contract and McCormick thought Gray had not. In need of funds Gray secretly sold half of his interest to William Ogden, ex-mayor of Chicago. Ogden had ample capital because of successful real estate speculations. Ogden paid Gray $7,000. A few months later the partnership with Gray was dissolved. During the next year McCormick was in partnership with Ogden and one William Jones. He made enough profits, however, to buy both of them out for $65,000 in 1849, and after that he was in business alone.[20]

To sum up the McCormick story, he got a crucial part of his capital for his Chicago factory from Gray and through him from Odgen. Secondarily he plowed back his own profits, and by continuing to do that he was able to buy out all his partners.

What does all of this investigation prove? It does not *prove* anything. But it does suggest some tentative conclusions to serve as hypotheses for a more intensive investigation. These tentative conclusions are as follows:

1. Unlike the majority of western settlers who moved west from the neighboring state where they were born, most manufacturers were born in Europe or in the East and came to the West fairly directly.

2. Most manufacturers were better educated than the pioneers or had come from a more educated environment.

3. Many of the manufacturers had not been farmers.

4. In a plurality of cases studied the primary source of funds of the manufacturers was savings from a variety of employments. The equipment the men needed was not so costly that a few thousand dollars would not permit them to start. After that they simply plowed back their earnings. If this system did not provide enough capital, then a man got a partner and the two did what one could not accomplish by himself. This explains the source of most capital.

5. Next to savings from employment, profits from trading or merchandising provided capital for manufacturers to get started. In some cases the transition was so gradual and logical as to be hardly notice-

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[20] William T. Hutchinson, *Cyrus Hall McCormick* (New York, 1930), pp. 234-66.

able as from cattle dealer to meat packer, blacksmith to plow manufacturer, furniture dealer to furniture manufacturer, etc.

6. Other primary methods of getting capital are worth noting but none loomed large. These include gold rush profits, real estate profits, profits from other or earlier manufacturing enterprises, and proceeds from the sale of farms.

7. There is surprisingly little, indeed suspiciously too little, evidence of borrowing from the East. That is, of course, something that a successful self-made man might not advertise. Until the early business records and family correspondence of many firms are examined, it may not appear as important as perhaps it was at the time.

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COMPANY-SPONSORED WELFARE PLANS IN THE ANTHRACITE INDUSTRY BEFORE 1900

A recent survey by the U. S. Chamber of Commerce reported that so-called "fringe benefits" are now taking 16.4 per cent of the payrolls of American industry as a whole.[1] Probably the best-known of these welfare programs is the United Mine Workers Welfare and Retirement Fund, which was started in May, 1946, by agreement between the union and the Department of the Interior, then operating the mines, and which was accepted by the operators when the industry returned to private hands.[2] The Fund is financed by a royalty on every ton of coal produced. The royalty was originally 5 cents a ton, but it has risen every year until it is now 50 cents a ton. The revenues of the Fund up to June 30, 1952, were $476,000,000; its expenditures in the same period were $387,000,000. These disbursements went to finance several different types of benefits—pensions for retired miners, hospital and medical care, rehabilitation of the disabled, maintenance of men who were permanently and totally disabled, and death benefits and maintenance aid for miners' families. The Fund is administered by three trustees: one named by the United Mine Workers, one by the operators, and one designated jointly.

Although welfare programs of this sort have become a prominent feature of industrial relations in the United States, their antecedents are almost unknown. The available evidence regarding early welfare programs has usually been limited to individual companies, and it has seldom been detailed. But in 1904 a pioneer investigator published considerable information about accident-benefit programs in the anthracite industry.[3] By expanding his data, it is possible to build a

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[1] Federal Reserve Bank of Boston, *News Notes*, Oct. 31, 1952.

[2] United Mine Workers Welfare and Retirement Fund, *Four Year Summary and Review for the year ending June 30, 1951* (Washington, D. C., 1951); *idem*, *Report for the year ending June 30, 1952* (Washington, D. C., 1952). Additional information was kindly provided by Lorin E. Kerr, M.D., Assistant to the Executive Medical Officer of the Fund. The material in the text applies only to the bituminous coal industry; a similar plan exists for the anthracite industry at the present time.

[3] Peter Roberts, *Anthracite Coal Communities* (New York, 1904), pp. 264-73.

fairly comprehensive and specific picture of company-sponsored welfare plans in that industry before 1900.

I

The anthracite industry was dominated by affiliates of nine railroads.[4] The largest of these firms, the Philadelphia & Reading Coal & Iron Company, established a Beneficial Fund which began operations May 1, 1877.[5] It was administered by three trustees appointed by the president of the company; usually they were the president himself, the presiding judge of Schuylkill County, and the president of the Safe Deposit Bank of Pottsville. When the Fund started, the company gave a $20,000 endowment, which was kept intact. Employees paid monthly premiums in rough proportion to their incomes: miners and inside laborers (*i.e.*, workers inside the mine), 30 cents a month; outside laborers, 20 cents; boys and old men, 10 cents to 5 cents, to be fixed by the district superintendent of the company in each case. For occupational fatalities, the Fund paid a cash benefit of $30 plus weekly benefits for a year scaled according to premiums; a monthly premium of 30 cents to 20 cents paid $7.00; 10 cents paid $2.80; 5 cents paid $1.40.[6] Benefits for occupational injuries ran for a maximum of six months and were scaled on the same basis as survivors' benefits, being $5.00, $2.00 and $1.00, respectively.

It soon developed that the premiums were inadequate to support the benefits; by November, 1899, the Fund had an accumulated deficit of more than $130,000. The monthly premiums were then raised to 50 cents, 40 cents, and 30 cents to 15 cents, respectively. By December 31, 1902, the deficit had been reduced to less than $5,000.

In the entire period May 1, 1877 to December 31, 1902, the Fund disbursed $1,924,287. Receipts were $1,919,577 of which $36,974 was

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[4] U. S. Geological Survey, *22nd Annual Report, 1900-1901* (Washington, 1902), Part III, p. 106; Eliot Jones, *The Anthracite Coal Combination in the United States* (Cambridge, 1914).

[5] U. S. Anthracite Coal Strike Commission, 1902-3, *Proceedings*, XLVII, 8050-8. Mimeographed copies of this transcript may be found in the Library of Congress and in the U. S. Department of Labor Library.

[6] The average contract miner, the highest paid class of labor in the industry, probably had an annual income of about $450-$500 in 1901. U. S. Anthracite Coal Strike Commission, *Report on the Anthracite Coal Strike of May-October, 1902* (Washington, 1903), pp. 177-80.

interest received on the endowment originally provided by the company, and the remainder (98 per cent of the total) came from premiums paid by employees. The company paid the administrative expenses of the Fund. Although an employee could withdraw by notifying the Fund of his desire to do so, almost all of the employees were members and had their premiums deducted from their pay.

Employees of the coal department of the Delaware, Lackawanna & Western Railroad, numbering some 14,000, received free medical care for themselves and their families at the Moses Taylor Hospital in Scranton, which had been established by the trust fund of a director of the company.[7] The surgeon-in-chief of this hospital was unable to defend his contention that mining was an "ordinarily healthy occupation,"[8] but probably it would be unfair to conclude from this failure that the surgeon was unable to care properly for his patients.

In 1887 the coal department of the Delaware & Hudson Company set up a voluntary benefit plan for its workers, and about 40 per cent of the 13,000 employees normally were members.[9] The program was financed by taking one day's pay from each man who wished to join, and the company put in an equal amount. When this fund was exhausted, the process was repeated, and so on. All clerical expenses were paid by the company. In case of occupational death, the fund paid $50 for funeral expenses, plus weekly benefits, for a year, of $3.00 to the widow and $1.00 to each child under twelve years of age. In case of disablement, it paid $6.00 a week for three months. The Fund in 1901 paid out in benefits a total of $16,340. From 1887 to 1901, it paid out $197,466.[10]

The Lehigh Coal & Navigation Company was one of the largest independent operators, with about 2,600 employees.[11] Its benefit fund was financed by a contribution from the company of ½ cent on each ton of coal shipped, plus ½ per cent of earnings by inside employees and ¼ per cent of earnings by outside employees. In case of death, the plan paid $30 for funeral expenses, plus weekly benefits for eighteen months of 50 per cent of the man's average earnings. A man in-

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[7] U. S. Anthracite Coal Strike Commission, 1902-3, *Proceedings*, XXXVII, 6138-43.

[8] *Ibid.*, pp. 6215-25.

[9] *Ibid.*, XXXI, 4886-92.

[10] Roberts, *Anthracite Coal Communities*, p. 269.

[11] U. S. Anthracite Coal Strike Commission, 1902-3, *Proceedings*, XLV, 7779-84.

jured at work received, after a six-day waiting period, weekly benefits of 50 per cent of his earnings, for a maximum of six months. From January 1, 1884, to January 1, 1901, the company contributed $192,-616 to the Fund; employees contributed $150,681; interest receipts were $20,510, making total receipts of $363,808. During this period the Fund paid benefits to employees of $308,613, and its administrative expenses were $15,310. Nearly all of the balance on hand of $39,884 was invested in bonds of the company.

G. B. Markle & Company, another large independent operator with 2,500 employees, maintained a pre-pay medical care plan.[12] Married men paid 75 cents a month for themselves and their families; single men paid 50 cents monthly. Most medical treatment was furnished without additional charge, but an extra fee of $5.00 was charged for the normal obstetrics case and prescriptions were often charged for. The company usually maintained four physicians, who were typically graduates of the Jefferson Medical College in Philadelphia or of the University of Pennsylvania Medical School. It also employed a nurse and two assistants, who made home visits in addition to working at the company aid stations. Employees automatically became members of this plan, but they could drop out by simply asking to have their names stricken from the rolls.

In the proceedings before the well-known Anthracite Coal Strike Commission of 1902-3, Daniel J. McCarthy, an attorney for the strikers, implied that Markle & Company profited financially from this plan by hiring inexperienced doctors at low salaries. But when called to the stand by the company as a witness, McCarthy was unable to sustain his charges, and admitted that the doctors employed were competent men.[13]

Both the Lehigh Coal & Navigation Company and Markle & Company were located in the Lehigh region, where all the operators were independents. Nearly all these companies had pre-pay medical plans, similar to the Markle program, at the time of the strike in that area in 1887-1888.[14] The Upper Lehigh Coal Company, like Markle,

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[12] *Ibid.*, XLIII, 7384-7401.

[13] *Ibid.*, pp. 7208-27.

[14] U. S. House of Representatives, 50th Cong., 2nd Sess., Report No. 4147, *Labor Troubles in the Anthracite Regions of Pennsylvania, 1887-1888* (Washington, D. C., 1889), pp. 481-482. Whereas the information taken from the *Proceedings* of the Anthracite Coal Strike Commission of 1902-3 was provided by the companies concerned, the following data is based on testimony before a partisan committee

charged 50 cents monthly for a single man and 75 cents monthly for a married man and his family. A witness before a congressional committee in 1888 charged that, where several members of a family worked for this company, the company deducted 75 cents from the father's pay plus 50 cents from the pay of each son. He also testified, in reply to a leading question, that the miners "do not approve" of this pre-pay system, and "would like to have a choice of their doctor." But the company allegedly deducted the doctor's charge even though the employee went to some physician other than the company doctor; in other words, it was a compulsory program. The witness said that he had "known a doctor to come to your house and notify you that he was the doctor of that town and nobody else." Although this testimony may be unreliable, the witness offered pay vouchers of two individuals employed by J. S. Wentz & Company, which showed "doctor" deductions of 50 cents and 75 cents, respectively.[15] The pay voucher of the Black Ridge Coal Company also contained in the deductions column a listing, "doctor," but nothing had been subtracted on this score on the voucher offered in evidence. Coxe Brothers, also in the Lehigh region, paid $5.00 weekly to the injured.[16] No other information is available about this program.

This broad survey shows that precedents can be cited for some features of the present United Mine Workers Welfare and Retirement Fund. Even before 1900, the major anthracite producers had conceded that compensation for occupational injuries and deaths was a legitimate cost to be charged against the production of coal. The Lehigh Coal & Navigation Company actually levied a royalty for this purpose against each ton of coal—the same method used today by the Mine Workers Fund. The widespread use, at least in the Lehigh region, of pre-pay plans for medical care was a recognition of the need to spread the costs of disability and illness.

The contrasts between these early plans and the present Mine Workers Fund are also striking. Retirement pensions take nearly 40 per cent of the expenditures of the current Fund; but before 1900,

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of Congress by a member of the Pennsylvania legislature from the Lehigh district. As noted below, however, this witness did offer documentary exhibits, consisting of company pay vouchers, for some of his testimony.

[15] *Ibid.*, pp. 489-91.

[16] Roberts, *Anthracite Coal Communities*, p. 268.

provision for aged workers was left to the whim of the company. These men might be furnished with free coal, or permitted to live in a company-owned house without paying rent. They might be given a small weekly subsidy for a short period. They might be transferred to a less grueling job, and some anthracite workers ended their careers where they had begun—picking slate on the breaker. Often the company assumed no responsibility at all for the support of an aged worker. Before 1900, weekly benefits, whether survivors' or accident, were normally 50-66 per cent of the weekly income; today they are considerably less. Before 1900, the programs in some cases were financed almost wholly by the workers; in others they were financed about equally by the employees and the company. The current Fund is financed entirely by a royalty on each ton of coal produced. The initiative in setting up the pre-1900 plans was taken by the companies, and effective control over the administration of the program seems to have been held by the company in every case. The Delaware & Hudson Company went the farthest in permitting worker participation, by setting up joint employee-management committees to determine when benefits should be paid, and by publishing annual statements on the operation of its plan. But the current Fund was established at the insistence of the union, and it seems probable that the union has exercised the major voice in its administration.

II

The evidence summarized above does not contribute direct answers to several major questions regarding these early welfare plans. In this concluding section, certain questions are posed, and hypothetical answers are advanced as a stimulus and possible guide to future research.

1. The early welfare programs were definitely a policy of the companies. What forces impelled each company to install its program? What did the company hope to gain by it?

(A) Medical facilities in the United States have always been concentrated in large cities. The anthracite mines were located in small cities or semirural areas with a low per capita income. These areas would not attract medical facilities without a guarantee of financial support.

(B) Mining, like railroading, was an extremely hazardous occupa-

tion.[17] The fatality rate in coal mining seems to have been somewhat higher than in railroading for the decade before 1902.[18] The fatality rate in the anthracite fields was higher than in bituminous mining for this period.[19] The coal employees of the Reading alone suffered more than 3,000 occupational fatalities, and more than 73,000 injured, from 1877 to 1902.[20] Most anthracite communities were one-company towns, so that the plight of the local widows, orphans, and cripples could be attributed to accidents at a single company. When these persons were in economic distress, the population demanded that the company should care for them. The company-sponsored welfare programs helped to allay this resentment, and also to transfer at least part of the economic burden to the employees themselves.

(C) Most of the executives of major anthracite companies were also railroad executives. So they must have known that the Railroad Brotherhoods all began as mutual insurance societies, and gradually took on the functions of collective bargaining.[21] Perhaps they hoped to avoid a similar evolution in the coal fields by establishing welfare plans under company control. In this way, the benefit funds might tend to unite employees with management, rather than uniting the employees against the management.

The circumstances under which the Reading launched its Beneficial Fund are suggestive in this connection. In 1871, the Reading entered upon a policy of buying coal lands in the anthracite region, by means of a subsidiary. These purchases were financed almost wholly by borrowing.[22] The company was badly overextended when coal prices began to sag. From 1875 to 1877, the average wholesale prices of all sizes of anthracite fell more than 50 per cent, and they remained

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[17] U. S. Anthracite Coal Strike Commission, *Report on the Anthracite Coal Strike of May-October, 1902*, pp. 27-31.

[18] *Ibid.*; also compare U. S. Bureau of the Census, *Historical Statistics of the United States, 1789-1945* (Washington, D. C., 1949), Series G 144-158, p. 154, to Series K 82-93, p. 206, although the figures are sufficiently ambiguous that they may not be comparable.

[19] *Ibid.*, Series G 144-158, p. 154; but see U. S. Anthracite Coal Strike Commission, *Report on the Anthracite Coal Strike of May-October, 1902*, pp. 27-28.

[20] Roberts, *Anthracite Coal Communities*, p. 271.

[21] Ray Ginger, *The Bending Cross: A Biography of Eugene Victor Debs* (New Brunswick, N. J., 1949), pp. 21-45, 55.

[22] Jones, *Anthracite Coal Combination*, pp. 29-31.

low.[23] The Reading went into receivership in 1880.[24] In its attempts to forestall these urgent problems of finance and marketing, the company precipitated a labor crisis in December, 1874, by trying to put through a sharp wage reduction.[25] A protest strike was called by the Miners' and Laborers' Benevolent Association. This strike dragged on for seven months before it was broken. Franklin B. Gowen, president of the Reading, then played the leading role in prosecuting for murder and other crimes many members of the Molly Maguires, a secret society in the anthracite region. It is noteworthy that these alleged criminals had also been prominent in the union.

Thus was the Miners' and Laborers' Benevolent Association destroyed. This organization had paid benefits for sickness, disability, and death.[26] Gowen evidently decided that the Reading should assume control of this function for its employees. The plan was announced in 1875, and the Beneficial Fund began operations on May 1, 1877, just seven weeks before ten Molly Maguires were hanged.

2. If these welfare plans were established in large part to mitigate labor unrest, how well did they achieve this goal? Protests were inevitably made about the application of the plan in specific instances. Some companies were suspected of using their medical plans to cheat their employees. Mention has been made above of the alleged desire of many workers to choose their own doctor. But it is virtually certain that these plans contributed to the maintenance of labor peace. In the proceedings before the Anthracite Coal Strike Commission of 1902-3, Clarence Darrow, the chief attorney for the strikers, commented on the welfare plan of the Lehigh Coal & Navigation

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[23] *Ibid.*, Chart I, p. 45.

[24] *Ibid.*, p. 31.

[25] *Argument of Franklin B. Gowen . . . In the Case of the Commonwealth vs. Thomas Munley . . .* (Pottsville, Pa., 1876); F. P. Dewees, *The Molly Maguires* (Philadelphia, 1877); Edward Winslow Martin, *The History of the Great Riots . . . Together with a Full History of the Mollie Maguires* (Philadelphia, 1877); John R. Commons and Associates, *History of Labour in the United States* (New York, 1918), II, 181-5; Anthony Bimba, *The Molly Maguires* (New York, 1932); James Walter Coleman, *Labor Disturbances in Pennsylvania, 1850-1880* (Washington, D. C., 1936); Philip S. Foner, *History of the Labor Movement in the United States* (New York, 1947), pp. 455-64; New York *Times*, December 7, 1947, p. 66, col. 1-4. These sources show a shift of judgment toward a more favorable view of the Molly Maguires.

[26] Andrew Roy, *A History of the Coal Miners of the United States* (Columbus, Ohio, n.d. [1903?]), p. 103.

Company: "The only fault we have to find with it is because it is not bigger."[27] Of course these welfare plans were not enough in themselves to prevent unionization and strikes. The anthracite strikes of 1887, 1900, and 1902, show that the workers usually regarded wages, methods of payment, hours, and union recognition as more important than welfare plans. Even before 1900, these plans were "fringe benefits."

3. Were the plans managed well or badly? Almost no evidence on this point has come to light. It is true that the Beneficial Fund of the Reading accumulated a very substantial deficit over a long period of time. This deficit may have resulted from bad management. But it may show a definite decision by the Reading to subsidize the Fund rather than to risk friction with its labor force by raising premiums.

Such questions are vital to an understanding of the present pattern of welfare programs in the United States. But definitive answers must await extensive research in the records of business firms. We may hope that business and labor historians will recognize the growing significance of this area as a field of possible research.

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[27] U. S. Anthracite Coal Strike Commission, 1902-3, *Proceedings*, XLV, 7784.

STOREKEEPING IN A MAINE SEACOAST TOWN: RECORDS OF THE W. G. SARGENT COMPANY

In many small New England towns during the nineteenth century, and even into the twentieth, all the business activities, centered usually about the general store, would be carried on by members of one family. Such a situation may be studied by means of a collection, comprising the records of the W. G. Sargent Co., of Sargentville, Maine, recently received by the Manuscript Division, Baker Library. The village of Sargentville, a part of the town of Sedgwick, is on the coast, east of Bucksport, and separated by a channel (now spanned by a bridge) from Deer Isle. Once there was a flourishing wharf (now demolished), where bait, fish, lime, ice, and granite were shipped up and down the coast, in return for products handled by the country stores in the vicinity. The Sargents, who seem to have given their name to the community about 1879, were at the center of this activity, building ships, arranging for their loads, and distributing the return goods, either as wholesalers or through stores they controlled.

The earliest papers in the collection relate to shipping and date from 1834, but it was not until 1843 that Captain Wyer G. Sargent fitted up a store in the basement of his dwelling.[1] Even then, he continued as a sea captain for two more years, while his wife managed the shop. In 1845 he retired from the sea and built a store, across the street from where the later and larger store was to be located. Ten years later (1854-1855) George M. Sargent, a younger brother, became a partner with him, under the firm name of W. G. Sargent & Co. In 1859 the name was changed to W. G. Sargent & Son, for Wyer's son, Rodney G. Sargent, became a partner. Rodney stayed only until 1864, when ill health caused him to go to Colorado. But that same year another son, Henry W. Sargent, gave up a seafaring life to clerk in his father's store, and in 1868 became a partner. Business had so increased by 1874 that a new building, with a basement and three

[1] Many details of the history of the firm are taken from an account in the Bangor Daily *News*, Apr. 21, 1920, written at the time the store passed out of the family's hands.

floors, was constructed. The firm continued under the direction of its founder until 1900, when Captain Sargent died at the age of ninety. Three years later a corporation was formed under the name of W. G. Sargent Co., with Henry W. Sargent as President, Arthur H. Sargent (Henry's son) as Treasurer, and George W. Grindal as Secretary. This corporation lasted until Grindal's death in 1917; and the following year Arthur H. Sargent died. Wishing to devote his time to investment and estate management, Henry W. Sargent turned over the business to a younger son, Percy, with Chandler Bowden and Ernest Grindal as assistants. Finally, in 1920, the store was sold to Henry B. Webb, of Portland, an office on the second floor being fitted up for the use of the Sargents, father and son. Now both store and office are gone, and the members of the family who gave the records to the Library return to the village only during the summer.[2]

The records of the business, under its various names, have been unusually well preserved, first at the store, then in the barn chamber of one of the Sargent homes. Each year, all the unbound papers, neatly bundled and labeled, were placed in small wooden chests. So voluminous were these records, it was decided to save only complete files for the period before 1850, and for the even decades (1860, 1870, etc.) thereafter. However, all the incoming letters were kept, regardless of year, and also a small segment of papers relating to ships owned by the company. These included the schooners *Martin L. Hall* (1848-1852), *Magellan Cloud* (1850-1852), *Martha Sargent* (1853), and *M. E Torrey* (1870). Bound volumes preserved include the daybooks to 1868, all the ledgers and cash books, trial balance books (1857-1880), outgoing letters (1863-1885), and stock on hand records (1868-1873). To compensate for the loss of the journals after 1868, which were badly water damaged, unbound balance sheets, drawn up on March 1 of each year, have been preserved.

From the point of view of activities, the nineteenth-century period is of most interest, years when ships were being fitted out, yarn let out to be spun, and branch stores (such as one at Deer Isle) in operation. Dollar volume of business seems to have reached a peak in the 1890's. With the coming of the twentieth century, the character of the region changed. More and more of the "fringe" activities came to be absorbed by such places as Bangor and Rockland, and the business became largely one of supplying natives and summer visitors with

[2] They are Miss Ruth F. Sargent and Messrs. Philip A. and Edward H. Sargent.

supplies. The progress of this change might be studied from these records, as well as from others in the Baker Library Manuscript Collections. A somewhat similar family activity is represented by the records of the Witherle store (1806-1890), located at Castine, not far from Sargentville. The wholesale side of the business could be studied in the account books of the Charles Hayward Co., Bangor, and the John Bird Co. (recently acquired by the Hayward Co.), Rockland; these records extend from 1860 to 1940.

Visitors to Sargentville now find, along a street of pleasant homes, a small store (adjacent to the building once occupied by the Sargent Company), a post office, and a gasoline station or two. The scene must once have been a much busier one, especially along the shore. We can be grateful that those responsible for the activity took time out to preserve so careful a record of it.

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FORD MOTOR COMPANY ARCHIVES

The dedication of the Ford Motor Company Archives on May 7, 1953, marks a milestone in research in the history of business in the United States. As far as the Editor of the BULLETIN knows, this is the first time a large American corporation has established a separate organization not only to preserve and handle its historical records but also to make them available to scholars for research. To one whose memory goes back to the days when it was nearly impossible to gain access even to old records of business concerns, this event has a very special significance.

Access by scholars to company records is, of course, not uncommon today. Several companies have deposited their historical records in public depositories, a notable example being the records of the Chicago, Burlington & Quincy Railroad in the Newberry Library in Chicago. Others have admitted scholars to their offices for research in their records. The Ford Motor Company has gone still further in that it has established a central depository, with a trained archival staff, which is open to accredited scholars.

The Archives are housed in the home of the late founder of the Ford Motor Company at Dearborn, Michigan. Fair Lane, with its spacious mansion and gardens, orchards, and woodlands on the Rouge River, was the home of Henry Ford from 1915 to the end of his life. It was fitting that it be made the historical center of the company he founded.

The Archives contains three distinct collections: a wealth of Ford photographs and photo-duplicated materials; a library of books and other publications; and the basic collection of primary documents.

The documents consist of two major collections. One is the private papers of Mr. and Mrs. Henry Ford; the other, the permanent noncurrent records of the Ford Motor Company.

A unique feature of the records collection is a considerable number of autobiographical memoirs prepared by the Oral History Section of the Archives. These include the recollections of associates of Henry Ford—friends, acquaintances in and outside business, and domestic employees—and of many individuals who held positions of respon-

sibility within the company or who had been employees of the company over a considerable period of time.

For the business historian the most valuable part of the Archives is, no doubt, the collection of original historical business records. These consist of personal papers of the executives, including a large amount of Henry Ford's own papers, and records of departments of the company. According to a publication of the Archives "Over 5,000 feet of records pertaining to finance, engineering, plant expansion, sales and advertising, manufacturing, production, industrial relations, purchasing and other major functions of the company contain the basic history of the Ford Motor Company's growth and development from 1903 to 1947."

EDITOR'S COLUMN

The source of management and capital for business enterprises is the subject of two articles appearing in the present issue of the BULLETIN. These articles illustrate the diversity of the beginnings of our modern industrial system.

The first article, "A German Eighteenth-Century Iron Works during its First Hundred Years," deals with beginnings and operations for a hundred years under the leadership of successive generations of members of the German landed aristocracy. A main source for this article is historically important in itself, a history of the iron works written by its general manager early in the nineteenth century. This article (to appear in three installments) is a part of a larger study of the business leadership provided by the European artistocracy which is being made by Dr. Fritz Redlich under the Research Center in Entrepreneurial History at Harvard University.

In "Financing Illinois Industry, 1830-1880," Donald L. Kemmerer introduces some significant questions concerning the source of capital for new manufacturing establishments in the United States in the nineteenth century. Historians have provided much information about the movement of capital from Europe into American transportation and from American mercantile fortunes into transportation and manufacture. Mr. Kemmerer's article deals with another, obviously very important, source, the savings of the small man and the ploughing back of his earnings into his enterprise. The author is a Professor in the Department of Economics at the University of Illinois.

Employee welfare plans, of which so much has been heard in recent years, are not a recent invention. In the article, "Company-sponsored Welfare Plans in the Anthracite Industry before 1900," Ray Ginger describes a number of programs which could be cited as precedents for several features of the United Mine Workers Welfare and Retirement Fund of 1946. The general significance of those early efforts lies in the fact that under them compensation for occupational injuries was regarded as a legitimate cost of producing coal. The author, Assistant Professor of Economics at Western Reserve University, in the present year holds the Business History Fellowship at the Harvard Graduate School of Business Administration.

EXECUTIVE SECRETARY'S ANNOUNCEMENTS

We are pleased to announce that Mr. JAMES F. DOSTER has been awarded the Business History Fellowship for the academic year 1953-1954. This Fellowship, awarded by the Business Historical Society, carries a stipend of $4,000 and enables an advanced scholar, usually the holder of a Ph.D. degree in history, to spend a year of study and research at the Harvard Graduate School of Business Administration. The recipient of the Fellowship is permitted free use of his time while at Harvard to pursue whatever aspects of the history of business he may choose. Mr. Doster received his doctorate in history from the University of Chicago. He will take a year's leave of absence from his duties as Assistant Professor of History at the University of Alabama.

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As the second book gift in 1953, the Business Historical Society has the honor to announce that it will present to its members a book written by one of its Council Members, Professor Richard C. Overton, of Northwestern University. The book is *Gulf-to-Rockies*, a history of the developmental years of what is now The Colorado and Southern Railway Company. Publication date is set for the fall of this year. The gift is being made possible through the generosity of the Chicago, Burlington & Quincy Railroad Company.

HARVARD STUDIES IN BUSINESS HISTORY

1. JOHN JACOB ASTOR, BUSINESS MAN
BY KENNETH WIGGINS PORTER

2. JAY COOKE, PRIVATE BANKER
BY HENRIETTA M. LARSON

3. THE JACKSONS AND THE LEES: TWO GENERATIONS OF MASSACHUSETTS MERCHANTS, 1765-1844
BY KENNETH WIGGINS PORTER

4. THE MASSACHUSETTS-FIRST NATIONAL BANK OF BOSTON, 1784-1934
BY N. S. B. GRAS

5. THE HISTORY OF AN ADVERTISING AGENCY: N. W. AYER & SON AT WORK, 1869-1949
Revised edition. BY RALPH M. HOWER

6. MARKETING LIFE INSURANCE: ITS HISTORY IN AMERICA
BY J. OWEN STALSON

7. HISTORY OF MACY'S OF NEW YORK, 1858-1919: CHAPTERS IN THE EVOLUTION OF THE DEPARTMENT STORE
BY RALPH M. HOWER

8. THE WHITESMITHS OF TAUNTON: A HISTORY OF REED & BARTON, 1824-1943
BY GEORGE SWEET GIBB

9. DEVELOPMENT OF TWO BANK GROUPS IN THE CENTRAL NORTHWEST: A STUDY IN BANK POLICY AND ORGANIZATION
BY CHARLES STERLING POPPLE

10. THE HOUSE OF HANCOCK: BUSINESS IN BOSTON, 1724-1775
BY W. T. BAXTER

11. TIMING A CENTURY: HISTORY OF THE WALTHAM WATCH COMPANY
BY C. W. MOORE

12. GUIDE TO BUSINESS HISTORY: MATERIALS FOR THE STUDY OF AMERICAN BUSINESS HISTORY AND SUGGESTIONS FOR THEIR USE
BY HENRIETTA M. LARSON

13. PEPPERELL'S PROGRESS: HISTORY OF A COTTON TEXTILE COMPANY, 1844-1945
BY EVELYN H. KNOWLTON

14. THE HOUSE OF BARING IN AMERICAN TRADE AND FINANCE: ENGLISH MERCHANT BANKERS AT WORK, 1763-1861
BY RALPH W. HIDY

15. THE WHITIN MACHINE WORKS SINCE 1831: A TEXTILE MACHINERY COMPANY IN AN INDUSTRIAL VILLAGE
BY THOMAS R. NAVIN

16. THE SACO-LOWELL SHOPS: TEXTILE MACHINERY BUILDING IN NEW ENGLAND, 1813-1949
BY GEORGE SWEET GIBB